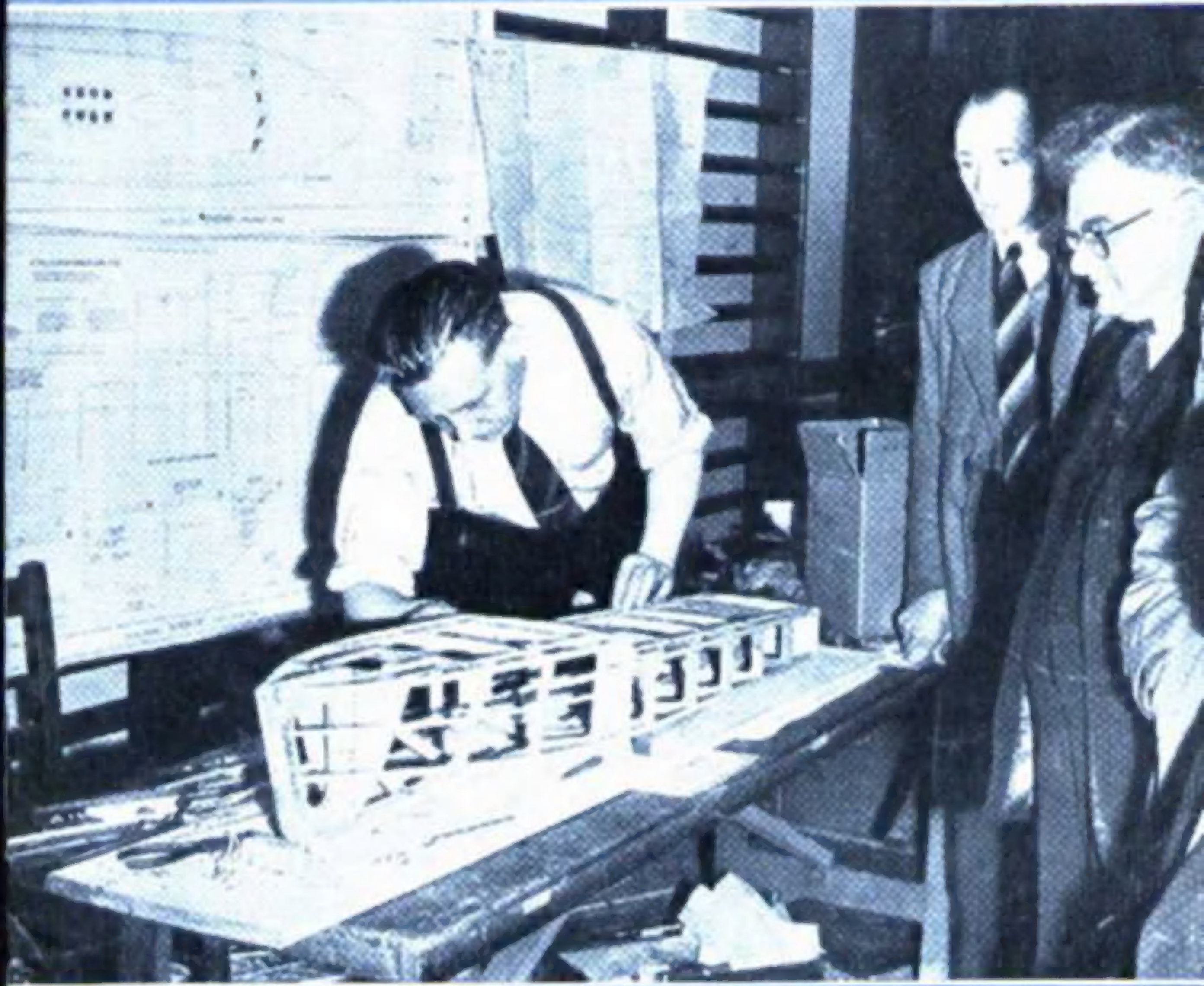
THE MODEL ENGINEER



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JULY 9th 1953
Vol 109. No. 2720

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 109 - No. 2720

JULY 9th, - 1953

ESTABLISHED 1898

PERCIVAL MARSHALL & CO. LTD. 19-20 NOEL STREET · LONDON · W · 1

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Our Cover Picture

At the recent exhibition at Sheffield, a working demonstration was organised by the Sheffield Ship Model Society. Starting from scratch, and working principally on his own, Mr. L. Leach had completely made and erected the keel, frames, and stringers of the large cabin cruiser shown, after perhaps twenty hours' work on three evenings and the Saturday. Before the exhibition closed, the skin was fitted to the bottom of the hull.

The frames were made from $\frac{1}{16}$-in. ply with square section strips glued on at the edges, and the keel, stem and stringers were laminated in three thicknesses, also cemented with a casein glue. The demonstration was of great interest to the visitors, and was further enhanced by Mr. Leach's charming young daughter, who was working simultaneously on a "solid" model of the early Cunarder *Britannia*.

The photograph was taken by "Northerner."

SMOKE RINGS

Natural Ability

IN GARDENING circles, the term "green fingers" is often used to denote a person who apparently has a natural aptitude for making things grow; and although in this particular case the talent may not lie in the fingers at all, there are many arts and crafts in which natural manual dexterity plays a very important part. In engineering, we find that out of a given number of apprentices or trainees who set out to learn the rudiments of craftsmanship, a small proportion will take to the work like ducks to water, a majority will acquire a reasonable proficiency slowly, and perhaps tediously, while a few will appear to have practically no mechanical ability at all. It is a rather ominous sign that there is an increasing number of people nowadays who seem to fall into the latter category, and we meet people who are apparently unable to carry out the simplest tool operations, such as driving a nail, inserting a small screw, or changing a sparking-plug on a car. We once knew a Doctor of Science who had written authoritative text-books on electricity, yet had to suffer inconvenience waiting for an electrician to repair a fuse or re-adjust an electric bell contact! It is, however, our opinion that few people are completely devoid of all mechanical ability; their deficiency often arises from either lack of training, or lack of interest, or both. Sometimes, however, they have never seriously tried to use their hands in any operation requiring dexterity, and lack of confidence deters them from trying to do so. We are often asked by untrained beginners of all ages, who wish to take up model engineering, what their chances are of becoming proficient, in view of what they consider to be a serious handicap in this respect. Our advice to such persons is to go ahead and persevere; a genuine interest in the task ahead is the first step on the road to success, and though the way may be hard at first, and early efforts disappointing, improvement is bound to come with practice. Many of our readers, including some who have never taken up model work until late in life, have been amazed at their own achievements, to say nothing of the pleasure which they derive from the ability to "make things" with their hands.

Another Handicrafts Exhibition

THE SECOND National Handicrafts and Hobbies Exhibition will be held from September 17th to 30th next at Central Hall, Westminster, S.W.1. The official opening will take place at 2.30 p.m. Thursday, September 17th, on the ground floor.

Wholly British in character, the exhibition emphasises the historical and traditional crafts and guilds and it caters for a wide and varied range of interests, including: marquetry; modelling; artificial jewellery; weaving and spinning; woodwork and carpentry; basketry; book-binding; leather work; toy making; embroidery; knitting; home-decorating; wireless; television; stamp-collecting; gardening; preserve-making sweet-making; pottery-throwing; glass-blowing; model railways and model ships.

There will be a number of unusual and practical demonstrations each day by experts, and will include: wrought-iron work; beaten silverware; marquetry; woodwork; yarn-dyeing; embroidery-work; a model forge; a working model railway and a puppet theatre. Of special interest to the younger generation will be Angora rabbit-keeping, bee-keeping, aquaria and doll-making.

The organisers are Henderson Exhibitions Ltd., 74, Holland Park, London, W.11, and there is a strong executive committee, representing many different crafts, under the presidency of Mr. C. E. Beal, F.Coll.H., F.R.S.A.

A Research MICROSCOPE

by Lawrence H. Sparey

IN our last article (June 4th issue) the limb and foot of this instrument were described. Since writing, I have obtained a set of the cast-iron castings, and have machined them up in order to satisfy myself that this material presents no hidden snags. I am able to report that the operation was entirely satisfactory,

Continued from page 693, *June* 4, 1953.

and that the castings are in a nice soft grey iron, which is as easy to machine as the original brass. In order that builders may have some idea of the job at this early stage, I present a picture of the castings just as they left my machine.

Mirror and Gimbal Mount

At the lower end of the limb, at the point marked *B*, Fig. 2, is attached the mirror mounting.

Two mirrors are required, one plane and the other having a concave surface. These mirrors are each 50 mm. in diameter, and may be obtained from the advertisers in this journal. They are mounted back to back in the housing.

It is hoped that the drawing showing the manner of mounting the mirrors (Fig. 5) will be clear enough to follow ; but, although quite simple in practice, it is a little

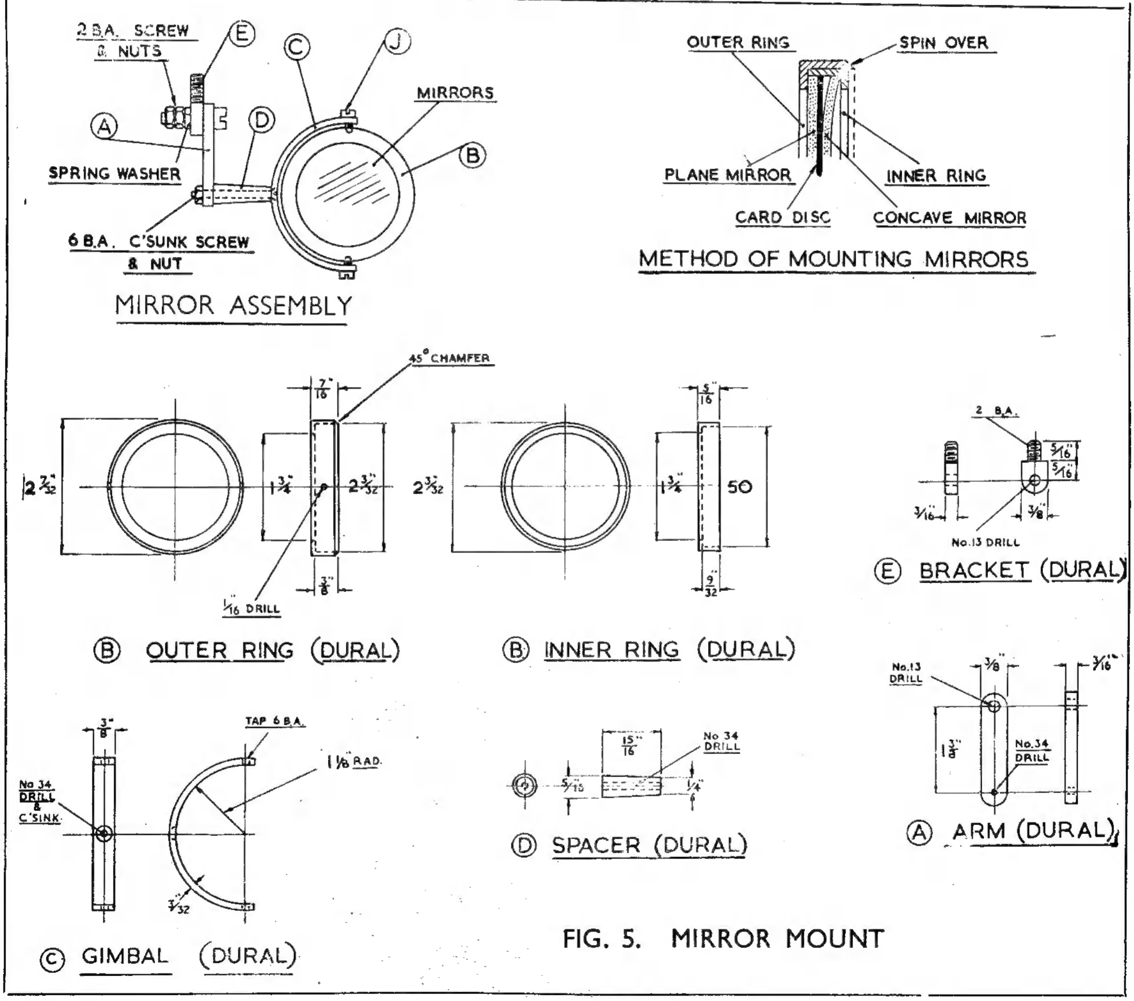
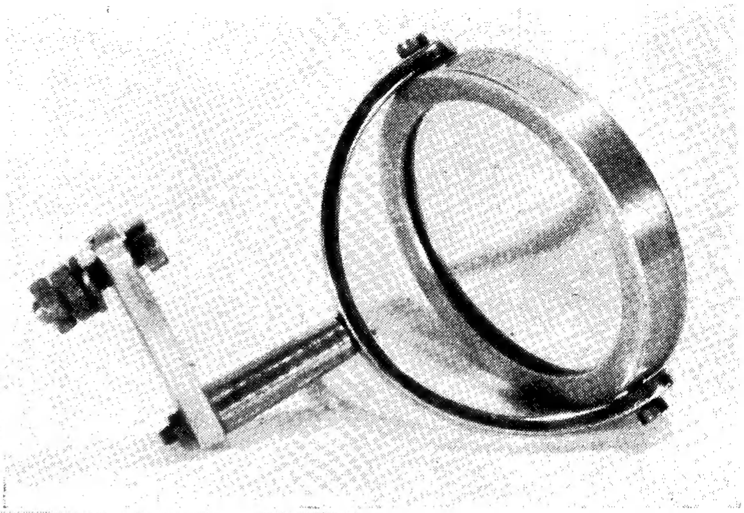


FIG. 5. MIRROR MOUNT

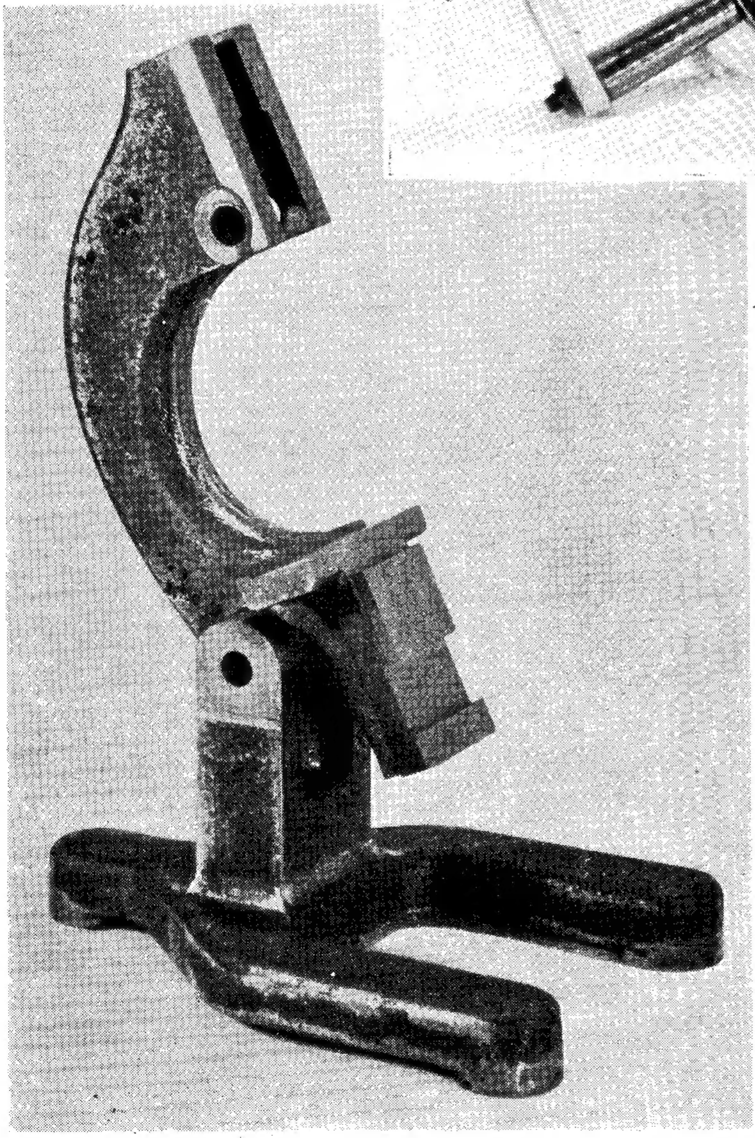
difficult to convey with the pen.

As may be seen from Fig. 5 the actual mirror mount consists of two rings, an inner and an outer. The inner ring is made to be a slide fit in the outer, and when assembled, the edge of the outer ring is lightly spun over.

The method of assembly is as follows: The plane mirror is placed, face outwards in the inner ring. Next, a disc, cut from a plain postcard, is placed upon the back of the mirror, and the concave mirror—again face outwards is placed upon this. The outer ring, or cap, is now pushed over the inner ring—in a manner similar to that of replacing the lid of a vaseline tin. As the inner ring is of less thickness than the outer ring, a small lip will be left protruding above the general level, and this lip—which is chamfered at 45 deg.—is then lightly spun over, thus securing the whole unit. Before undertaking the assembly, do not forget to drill the two $\frac{1}{16}$-in. holes in the outer ring into which the two gimbal screws *J* are located. If you try to drill these after the glasses are spun in, it is probable that you may touch the edge of the mirrors with the drill point, and new mirrors will be indicated!



Mirrors and gimbal mounting



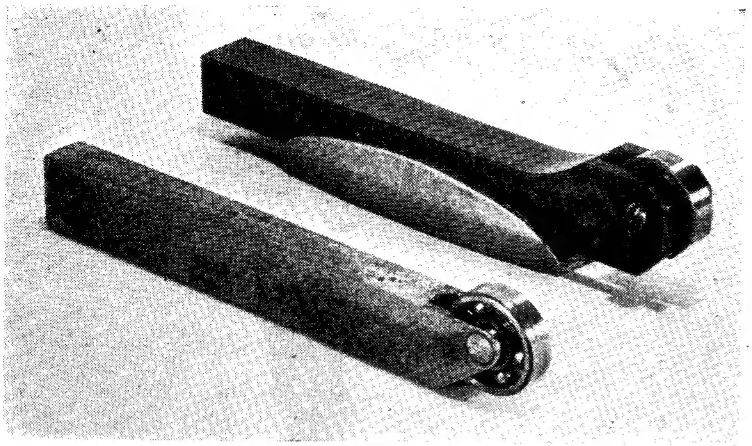
Limb and foot machined in cast-iron. Note the spot-facing on the slow-motion locations

Spinning Operation

The reason for using two rings in this way is that, during the spinning operation the pressure is not taken by the mirrors, but is carried by the wall of the inner ring. Spinning directly upon the mirrors would be really asking for it!

Spinning is an operation rarely undertaken in the home workshop, and a few notes may be helpful. In the first place, a spinning tool is necessary. Ordinary spinning tools may be just a plain, rounded and polished piece of silver-steel rod, but this would be a little too harsh for the delicate spin-over we require.

The photograph shows two tools of the type suitable. The one in the foreground is a tool specially made for this purpose, and I have used it on many small spinning jobs. Many engineers, how-



Front : Special spinning tool. Rear : Similar tool improvised from a knurling-tool holder

ever, will not care to make such a tool specially for this one occasion, so I show also a temporary spinning tool which can be made up in a few moments. It consists of a standard knurling tool holder with the knurl removed and a $\frac{1}{4}$-in. bore ball-race substituted.

A problem arises as to the most suitable manner in which to hold the job in the lathe during the spinning process, as it is obvious that plain chucking would be too drastic. In my own case, I chucked a piece of hardwood, and bored it out to be a press-fit on the mirror assembly. The edge was then spun over at slow speed and light pressure. The assembly was first roughly secured by pressing over a small dent in the spinning edge while the job was still on the bench. This stops the mirrors from falling out when the job is first revolved in the lathe.

Body-tube Slides

Once the limb and foot are machined, we are fairly launched on our project, and may turn our attention to some of the most interesting work of the whole job. This is the machining of the slides. It will be assumed throughout these articles that the only machine available is a $3\frac{1}{2}$-in. lathe; but, of course, a drilling machine would be a welcome addition—although this is not absolutely necessary.

Before commencing operations, it is essential to obtain the necessary milling cutters. These are as follows: One 60-deg., inclusive, dove-tail end-mill, $\frac{3}{4}$ in. diameter. One parallel end-mill, $\frac{1}{8}$ in. diameter. One parallel end-mill, $\frac{1}{4}$ in. diameter. One ditto, $\frac{5}{16}$ in. diameter. One ditto, $\frac{1}{2}$ in. or $\frac{3}{4}$ in. diameter. Armed with this modest equipment, we may undertake any of the extensive milling operations which the job requires.

The sole difficulty in the manufacture of all the slides is to keep all faces square and parallel to each other. Thus, the vee-slides must be parallel to each other, and to the sides of the material. They must also be truly square to the faces of the material. This may sound very formidable, considering the limited equipment which is likely to be available; but, fortunately, there is a simple way out, which produced, in the original microscope, slides which were perfect throughout. This was done by using a jig of such a form that the slides could be removed, replaced, turned end-for-end, and back-to-front, with the assurance that the job would be "square" in all circumstances.

This brings us to Fig. 6, in which the jig is shown ; this fits the Myford vertical slide, but will be suitable for most others if the $\frac{5}{16}$ in. clearing holes are spaced to fit the distance between the tee slots of the slide. In the case of the Myford slide, the distance is $2\frac{11}{16}$ in. It is probably better to make the jig-plate of brass, as this is easier to mill on the lathe than is steel, and a piece 4 in. by 4 in., by $\frac{1}{2}$ in. thick is required. The bottom of this should be roughly flattened with a file, the $\frac{5}{16}$-in. bolting holes drilled in, and the $\frac{5}{16}$-in. B.S.F. studs fitted. It may then be bolted to the vertical-slide, and roughly lined-up to be at a right-angle to the edges of the lathe ways. Once this has been done, it is essential that everything be securely clamped up, as, under no conditions, must the jig be allowed to shift throughout the whole of the milling operations.

Now, with the largest end-mill held in a chuck or collet, the large slot, $\frac{1}{8}$ in. deep, is milled across the whole width of the plate, making sure that the bottom of the slot is perfectly flat and even. During the final cut, the lathe carriage should be locked in position. The cutter is now changed for the 60-deg. cutter, and the lower lip of the slot is given the 30-deg. angle, as shown in the drawing. The original end-mill is now replaced, and the sharp edge of the vee is flatted as indicated. Provided that the jig is not disturbed

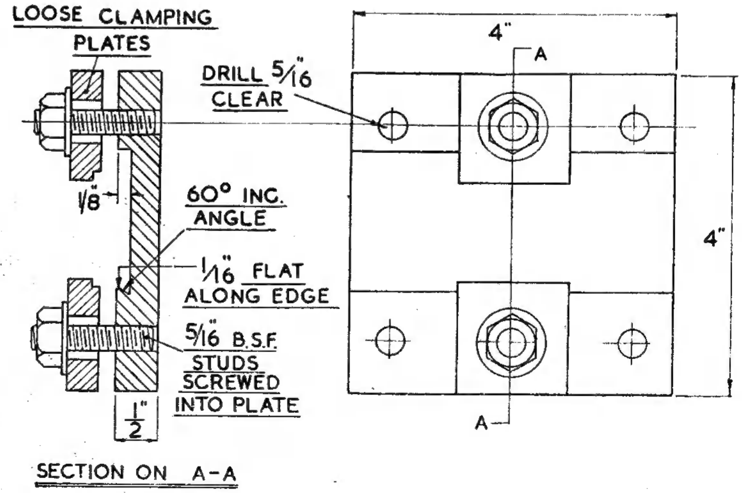


FIG. 6 MILLING JIG FOR VEE SLIDES

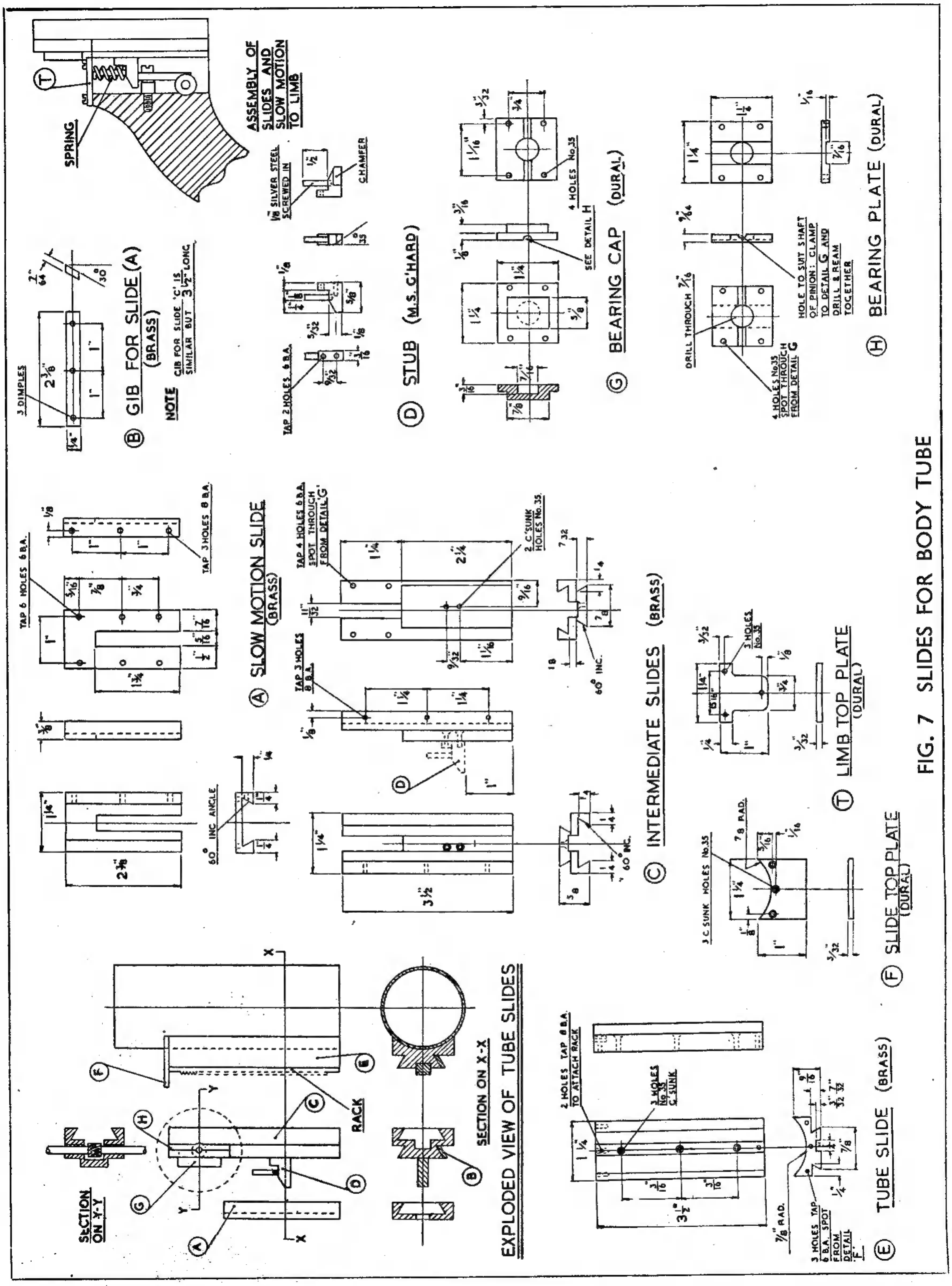


FIG. 7 SLIDES FOR BODY TUBE

on the vertical-slide, we now have a location for the work-pieces that is truly aligned with the axis of the lathe. This jig, by the way, is equally useful for the milling machine or the shaper, and should, in both these instances also, be machined *in situ*.

Machining the Vees

When machining the slides, it is better to machine the male vees first, and to take a light facing cut, using the large end-mill, over the large, bottom face of the slide. If this is done, the work may be removed, turned completely round, and the male vee located in the lower vee slot of the jig. The new face may then be end-milled as may be indicated.

In like manner, the edges of the work may be cleaned-up parallel with the vees; in this instance, use only the lower clamping plate, which should, for this operation, be longer than that shown in the drawing, so that the work-piece is held nearer to the middle.

The Slow-motion Slide (A, Fig. 7)

With the aid of the drawings and photographs, a fairly clear picture of the slide assembly should be obtained. In the photograph, Fig. 8, the slides are shown in the order of assembly. The pinion and shaft is, of course, clamped between the two bearing plates, and screwed to the top of the longer slide, so that the pinion engages with the rack through the slot shown. On the pinion shaft may be seen a small spring washer, which is partially recessed into the shank of the knob, and takes up the side thrust of the helical gearing.

The slow-motion slide itself has one perfectly flat face, and has milled into it, a long slot through which protrudes the stub (*D*). This flat face is screwed to the limb of the microscope, so that the stub may engage with the hanging lever of the slow-motion mechanism. The other side of the slide has plain, female vees milled into it.

Intermediate Slides (C, Fig. 7)

These slides are a little more complicated, and it is here that the value of the milling jig will be apparent. While one face carries a female vee-slide, the other face has a male vee-slide which engages with the slow-motion slide just described. It will be seen in the drawing that the male slide is off-set, which is done to provide room for the gib-strip, and if made to the measurements shown, the slides will line-up perfectly when assembled.

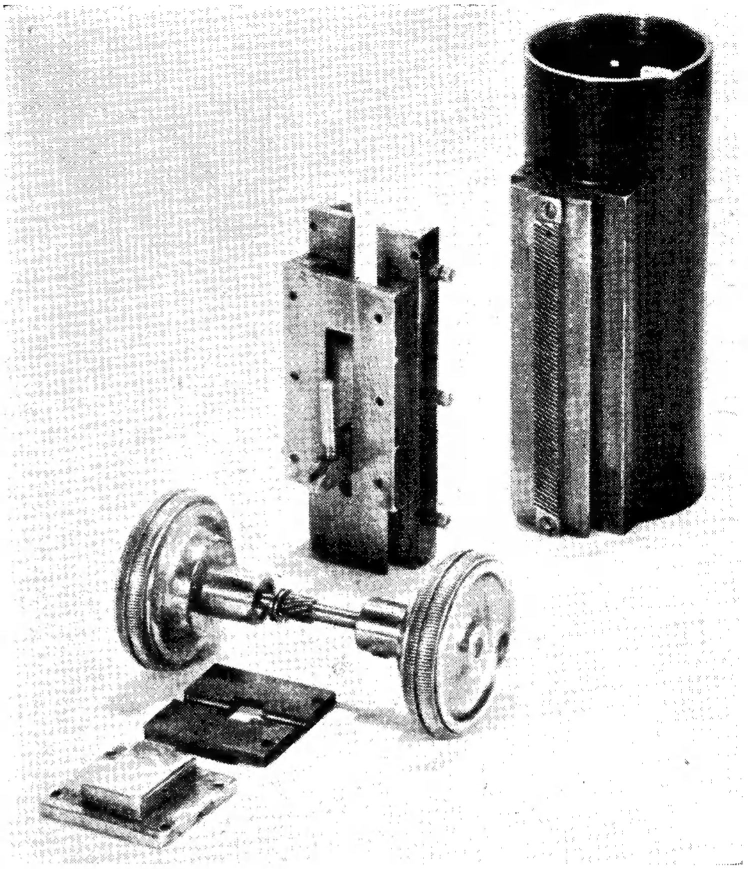


Fig. 8. Exploded view of the body-tube assembly. The adjusting-screws for the gib strip are well shown. The smaller slide has similar screws on the opposite side

Tube Slide (E, Fig. 7)

While one side of this slide carries a male vee, the other side is radiused out to be a snug fit upon the body-tube. In my own case, this radius was machined with a fly-cutter held in a boring-bar between centres, with the material clamped to the cross-slide of the lathe. To avoid awkward packing to correct height, a piece of flat, brass bar, of $\frac{5}{8}$ in. thickness was used, and the radius was milled out until it just contacted the sides of the bar. The correct thickness—$\frac{9}{16}$ in.—was obtained during the milling operation. A piece of brass bar, $3\frac{5}{8}$ in. $\times$ $1\frac{1}{4}$ in. $\times$ $\frac{5}{8}$ in. will, therefore, be wanted for this job. The long $\frac{1}{4}$ in. wide slot, to locate the rack, will be noted. Although the body tube is indicated in this drawing, its description will be left for our next article.

Bearing Cap (G) and Bearing Plate (H, Fig. 7)

The chief difficulty to be encountered here lies in the method of holding during machining operations, due to the thinness of the finished job.

It will be noted that the drawing is very liberally besprinkled with drilled and tapped holes, and indication has been given in those instances where they should be spotted through from the mating component. Care should be taken to drill these holes in the sequence given, otherwise some very tedious marking-out and accurate drilling will be encountered.

In the next article I hope to give details of the method used in cutting the racks and pinions, which, in spite of their seeming complexity, may be done extremely well on a $3\frac{1}{2}$-in. lathe.

(*To be continued*)

READERS' LETTERS

● Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

HAND ENGRAVING

DEAR SIR,—Further to your readers' letters upon the above subject Mr. Wallace Bolton may care to know that the famous Thomas Bewick (born 1753, died 1828) a wood engraver, was apprenticed to Ralph Beilby, Newcastle-on-Tyne, on October 1st, 1767, for *seven* years. His master's business lay in engraving crests and initials on watch seals, teaspoons, sugar-tongs and other pieces of plate, and the numerals and ornaments on *clock dials*, together with the maker's name. Here then was young Bewick's 'prentice work—the master of white line on the wood block. Later, Bewick confessed to a friend that when engraving these *clock dials* his hands grew as hard as a blacksmith's, and almost disgusted him with engraving so that he nearly abandoned his craft.

All the best of luck to Mr. Bolton.

Yours faithfully,

Hastings. F. K. CHALLEN.

INTERESTING STEAM ENGINES

DEAR SIR,—The illustration of Mr. R. Elvy's compound mill engine on page 514 of the April 23rd issue of THE MODEL ENGINEER was of great interest to me. Back in the early 1920s, when I was working in a machine shop in Yarmouth, Nova Scotia, we did a repair job on the engine-room telegraph of a ship which had an engine with similar mechanical features. This ship was a "buoy boat" or lighthouse tender, operated by the Canadian Government Department of Marine and Fisheries, or, as it is now known, The Department of Transport. The ship was called *Aberdeen* and I believe was built in Scotland.

The engine was a two-crank, quadruple expansion job, with two complete units such as the one in the illustrations, with, of course, variations to suit it to marine service. The triangular connecting-rods did not have the vertical bar extending from the big-end bearing up to the boss which carries the end of the rocking lever. One rocking lever was extended out beyond the column to work pumps, but I cannot recall whether or not the second rocking lever also worked pumps.

The cylinder centre-lines were closer together than those in the mill engine. I have forgotten the arrangement of the valves but am reasonably sure that they were worked by Stephenson link motion.

I was told that only two such engines were built for marine service, and until I saw the illustration and description of the mill engine, I was not aware that any were built for stationary work.

These engines of uncommon design make an interesting study.

Yours faithfully,

New Brunswick, Canada. A. RONALD ALLEN.

DARKROOM CLOCKS

DEAR SIR,—It was interesting to note that Mr. D. Birchon made "a simple darkroom clock," as I had had two in use for many years. One, a small $2\frac{1}{2}$ in. round timepiece, I used as an egg-timer, but I found that one had to watch it for the $3\frac{1}{2}$ minutes, so I converted an old American striking clock and made it to hang on a wall, and for the pendulum to be in view below. Now one sets the hand from front to zero or "4" and sets the pendulum going and just before the $3\frac{1}{2}$ minutes the clock strikes on bells as warning; this was easy to arrange by a small adjustment. Of course, I had to leave two teeth on the escape wheel and readjust length of pendulum. Your readers will understand that it is possible to make the dial to read whatever they wish, in accordance with the number of teeth that are left on the escape wheel and also the length of pendulum adjusted accordingly. My dials are practically the same as Mr. D. Birchon's, but I have the minutes coloured red for the whole circle and a red minute hand.

Yours faithfully,

Hastings. F. K. CHALLEN.

MAGNESIUM ALLOYS

DEAR SIR,—With reference to the recent correspondence on melting aluminium over an open fire, and the possible danger of elektron being placed in the pot in mistake for aluminium, here is a simple test to find out if the metal is elektron or otherwise. Hold the metal over a piece of paper and run a file over it, then shake filings on to the fire. If this results in a series of bright blue sparks, then the metal is elektron. Another simple way is to saw off a small portion and place it in a red part of the fire; if it burns with an intense glare, then again it is elektron. It may fall through the fire while burning, and all that is left, is a white powder. To anyone used to machining this metal the smell is distinctive, and one has only to use file or hacksaw on same, and the smell of magnesium is apparent.

Yours faithfully,

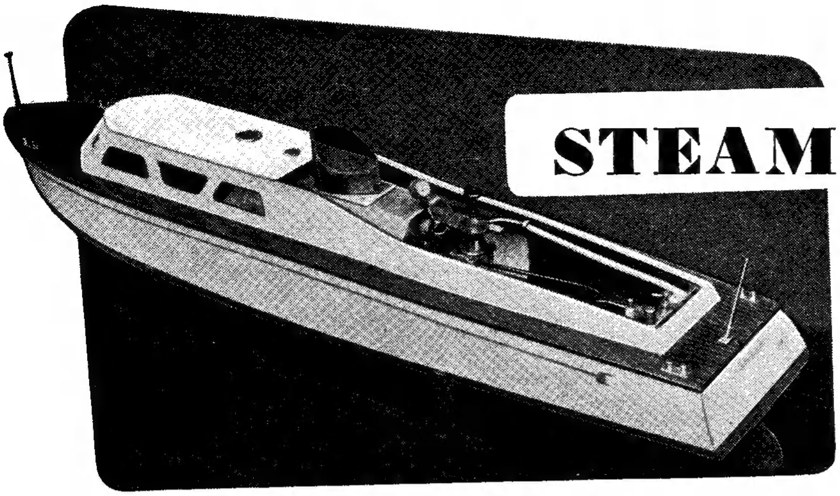
Gateshead. J. G. BELL.

SCENIC WORKING MODELS

DEAR SIR,—The interesting scenic electric clock by R. N. Gibbs described in THE MODEL ENGINEER of June 11th could be greatly improved by the simple addition of a rolling motion combined with the pitching. I would suggest that the hull should be pivoted longitudinally between the prongs of the pitching fork, just below sea level, with a short piece of stiff wire fixed into the hull at right-angles to the fore and aft line, also a little below water level, this wire to enter a small hole in a vertical support fixed to the chassis. If this was fixed well forward on starboard side, it would give a combined pitching and rolling motion which would be effective. I would also suggest that the cam should be irregular in contour, which would give a less mechanical appearance to the motion. Mr. Gibbs should get a photograph of a four-masted barque and see that his sail plan is correct and various sails in proportion. His spanker and gaff topsail are on the wrong side of the mast. With these slight alterations, and if he makes sure his seas run correctly to the wind, as shown by set of sails, he will have a beautiful little scenic clock. The lighting must be most effective. I think if I saw it working I would feel like slackening my belt and preparing for a meal of pea soup and salt pork!

Yours faithfully,

Winscombe. A. STARKEY, *Master Mariner (Ex-C.).*



A hard chine STEAM LAUNCH

By R. Stark

THE model shown in the accompanying photographs is the result of a joint effort by my brother (N. Stark), and myself.

For a number of years we have had a small garden workshop, equipped with the usual hand tools necessary for our hobby of light carpentry and model making. On becoming regular readers of THE MODEL ENGINEER, we realised the valuable detailed information available in this paper on the construction of all types of working models, and my brother decided to get a lathe. An "M.L.7." was duly installed.

A model steam boat was decided upon, and after casting around, Messrs. Bassett-Lowke's *Streamlinia* was chosen for our first attempt. Although this launch is a simple, straightforward type to build (no frills), she has pleasing lines, and there is easy access to the power plant. When built, this hull would serve to try out several types of power plant, with very little adaptation.

In the issue of THE MODEL ENGINEER for August 18th, 1949, a design by Mr. Feilden was published for a $\frac{5}{8}$ in. bore and stroke launch engine. This seemed to be a suitable engine for our job, and so my brother started on the engine, while I tackled the hull.

I wanted to carve the hull from the solid, and so my problem was to find a suitable piece of timber. I was giving up the search, when I was offered two pieces of pine, each 4 in. by 4 in. and 44 in. long. In desperation I glued the two chunks together and got busy carving. The hull was formed in the usual manner, using card templates (or shadows) traced from the drawings to test the various stations along the hull. The inside was hollowed out to leave a uniform shell thickness of $\frac{3}{8}$ in.; templates were again brought into use. The longitudinal glued joint was strengthed inside by screwing over it a strip of aluminium, 1 in. wide, $\frac{1}{16}$ in. thick. A flat stern board was inserted to avoid the weakness of end grain.

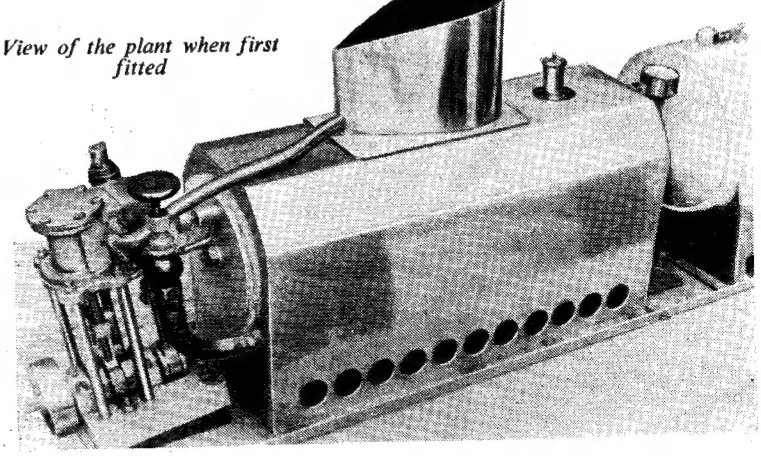
The deck was cut from $\frac{3}{16}$-in. plywood, and scored with a scriber to represent planking. I cut the cabin sides from solid pine, in preference to steaming them to shape, and the waste was negligible. The cabin windows were left unglazed, as I thought this might interfere with the air supply to the spirit burner. The bollards and flagstaff sockets were turned from brass, using a form tool. The flagstaffs were made from rustless steel.

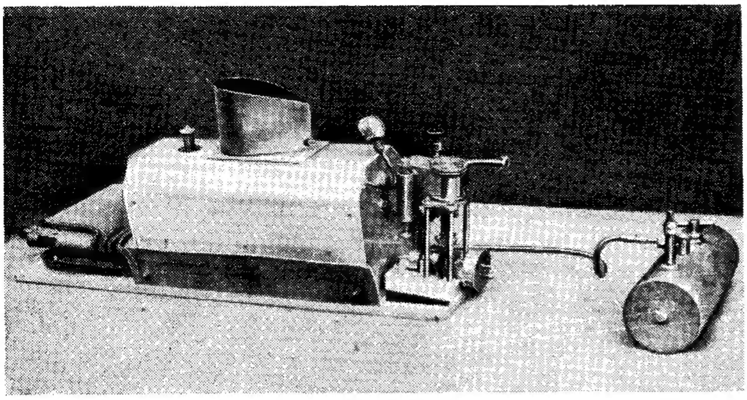
Next, the hull was finished outside in red and cream enamel, six coats at long intervals, each coat being well smoothed with fine glass-paper before applying the next. The inside was brought to the same finish, using light-brown enamel. The plywood deck was stained and varnished all over.

Meanwhile my brother had been constructing the engine, following closely the published design. No castings were used, only stock materials. We worked together to make the boiler, using 8 in. of 16-gauge solid drawn copper tube, $2\frac{1}{2}$ in. in diameter. Plain disc ends were held by a $\frac{1}{8}$ in. copper stay against copper strips riveted to the inside of the boiler. Four water tubes, $\frac{3}{8}$ in. diameter, 20-gauge thick were fitted. All joints were silver-soldered. The only boiler fittings were a filler cap, safety valve, and steam dome. The boiler was tested with water to a pressure of 175 lb. per sq. in. The boiler casing is of aluminium, lagged inside with asbestos. The steam pipe runs from the dome along the boiler through the flame area to ensure dry steam. Outside the casing it has a very short run to the engine—$1\frac{1}{4}$ in., which is well lagged.

The exhaust pipe was originally led to the funnel, but experience proved this to be too messy. On starting the engine, condensate and drops of oil were thrown over everything. To avoid this the exhaust pipe was led out at the stern.

View of the plant when first fitted





The plant with blowlamp

The boiler and engine are bolted to an aluminium base, which is secured inside the boat with four wood-screws. Thus, it is the work of a few minutes to remove the complete plant when required.

Methylated spirit firing was first tried. A tank holding about ½-pint of methylated spirit was arranged to be heated by a small wick-type spirit burner. The spirit vapour produced is led off and burnt in a perforated burner beneath the boiler. This arrangement gave good results; steam could be raised from cold in a few minutes and working pressure maintained without difficulty. Regulation of this burner was easy—by increasing or decreasing the flame of the wick lamp.

With this plant the boat gave a good performance (about 5 to 6 knots), with a duration of 25 minutes and no danger of a dry boiler.

However, the boat was rather bow-heavy. We realised that this was due to the position of the fuel tank, but the system of firing would not allow us to place it in the stern. This nearly lost the boat for us as it turned out.

We were steaming her one Saturday morning on the local lake—a stretch of water about ¾-mile long. It was rather choppy, and occasional wavelets could be seen breaking over the bows and entering the unglazed cabin windows. Before we could do anything, she sank.

At the time we were somewhere in the middle of the lake, in a row-boat, a few yards from where *Streamlinia* went down in 6 ft. of water. Despite rowing to and fro over the area we could not see her. A further search in the afternoon, when we were armed with hooks and tackle was again unsuccessful. This time her estimated position was marked with two "bottle buoys."

The next day was Sunday—no boating permitted. On the Monday morning the water was like a sheet of glass, and we headed the prow of our rowing boat for the space between the two "buoys." Within ten minutes *Streamlinia*, covered with weed, mud, and water-snails, was in the boat beside us.

Back in the workshop she was quickly stripped down and cleaned. Surprisingly enough, she had suffered no damage. The glued joints and the plywood deck had withstood the 48 hours' immersion perfectly—thanks to the painting job.

It was obvious that the trim of the boat would have to be altered, and the forward windows, at least, fitted with Perspex. It seemed to us that a paraffin blowlamp would solve our problem of trim, as the fuel tank could be placed almost anywhere in the launch, in this case, of course, in the stern. After looking through *Model Steamers and Motor Boats* (a Percival Marshall Publication) a design was obtained for a paraffin blowlamp. A few experiments were necessary to get this to burn under our "pot" boiler. It was also necessary to modify the boiler casing by fitting a gauze flame baffle, and additional lagging.

While no claim is made for efficiency regarding the amount of steam raised for the fuel used, the blowlamp is a thoroughly reliable job, and, if fully opened up, will provide heat well in excess of maximum requirements. This blowlamp incorporates an adjustable jet, and the fuel container is fitted with an ordinary cycle valve which functions perfectly.

These alterations gave the boat a better trim in the water, and a better turn of speed. Now, with these alterations, and the additional precaution of a ball float attached to the hull by a long piece of line, we can send her away on a free run with complete confidence.

The model has provided us with many hours of pleasure, both on the bench and at the lake-side. From it we have got a first-hand knowledge of the running of an elementary marine steam plant, and we have put the knowledge to good use in our present model, a 42-in. all-metal steam tug which is nearing completion. We would like to say how valuable THE MODEL ENGINEER has been as a source of information, without which we would never have tackled this job.

ALUMINIUM SOLDERING

I FEEL I may be able to offer a little information concerning a subject which has been under discussion for some time: I refer to the soft-soldering of aluminium. This method I have adopted is by no means meant to be the last word, but at least it works, which is more than I can say for some of the theories put forward from time to time.

Materials

Cleaning Fluid.—Phosphoric acid, 20 per cent.; nitric acid, 10 per cent.; water, 70 per cent.

Wetting Agent.—"Quix" (household grease solvent).

Tinning Solder.—Tin, 90 per cent.; zinc, 10 per cent.

Tinman's Solder. Vaseline.

Method

(1) Scrape the metal clean, apply cleaning fluid plus a *trace* of the wetting agent and allow to stand for three or four minutes, then wash in running water.

(2) Heat the job with a blowlamp and tin the surface with tinning solder. (Melting point of aluminium 1,210 deg. F., 654 deg. C.)

(3) Smear the joint surface and a stick of ordinary tinman's solder with vaseline, and complete the job in the normal way.—JOHN A. PARKES.

Locomotives at Birmingham

Described by "Northerner"

This beautifully finished $3\frac{1}{2}$-in. gauge "Stirling Single" locomotive is being built by H. M. Savage, of Birmingham

AT the Birmingham Exhibition there were many fine locomotive models, and, of course, quite a few of them were in chassis form—among them the Midland compound described in my previous article.

Another beautifully-made chassis was that for a $3\frac{1}{2}$-in. gauge "Stirling" single-wheeler which is being built by H. M. Savage—who incidentally had been responsible for compiling that monumental exhibition catalogue for the Birmingham club. This engine is being made to the Doncaster works drawings, and will be absolutely correct except so far ■ the needs of "working" dictate. The works number of the prototype is 1006, by the way, which has certain differences from other classes of the Stirling.

Castings for the wheels were obtained from H. P. Jackson of York, but for the cylinders Mr. Savage made his own patterns, and obtained bronze castings at ■ local foundry. The Stephenson link motion was designed by making ■ model to quarter full size, and gives 82 per cent. cut-off in full gear.

Many of the parts are fabricated; this applies to the motion-plate, and to the bracket for the screw reversing-gear, which, by the way, has ■ square thread. The cross-heads, which are cottered to the piston-rods, are built up in steel, with inset brasses.

The frames are in steel, of course, and are correctly set in or tapered towards the front buffer beam to allow the bogie to swing; the beams are of the proper "wood sandwich" pattern. Leaf springs are fitted to the trailing wheels, and to the bogie.

To make the curved footplates, Mr. Savage made a set of rolls, and says that these made the task much easier. Riveting was done by means of a screw press, and not by hammering, so that there was no risk of damaging the plating, which is very beautifully finished indeed. In fact, the finish of all parts of this fine chassis was beyond reproach.

A particular point of interest about the engine is that the lubricator has an easily-adjusted variable stroke, so that when running light, less oil will be pumped to the cylinders, and vice versa. The lubricator is concealed under the footplate behind the buffer-beam, and the lamp-bracket ingeniously forms the catch for the removable plate which allows access to it.

Incidentally, Mr. Savage's workshop is a very small one, being an alcove in the dining-room which is equipped with a Willimott $3\frac{3}{4}$-in. lathe, and, until a week or two ago, a hand drilling-machine. The latter has now been replaced by a powered model, but all holes in the engine so far have been drilled either by hand or in the lathe.

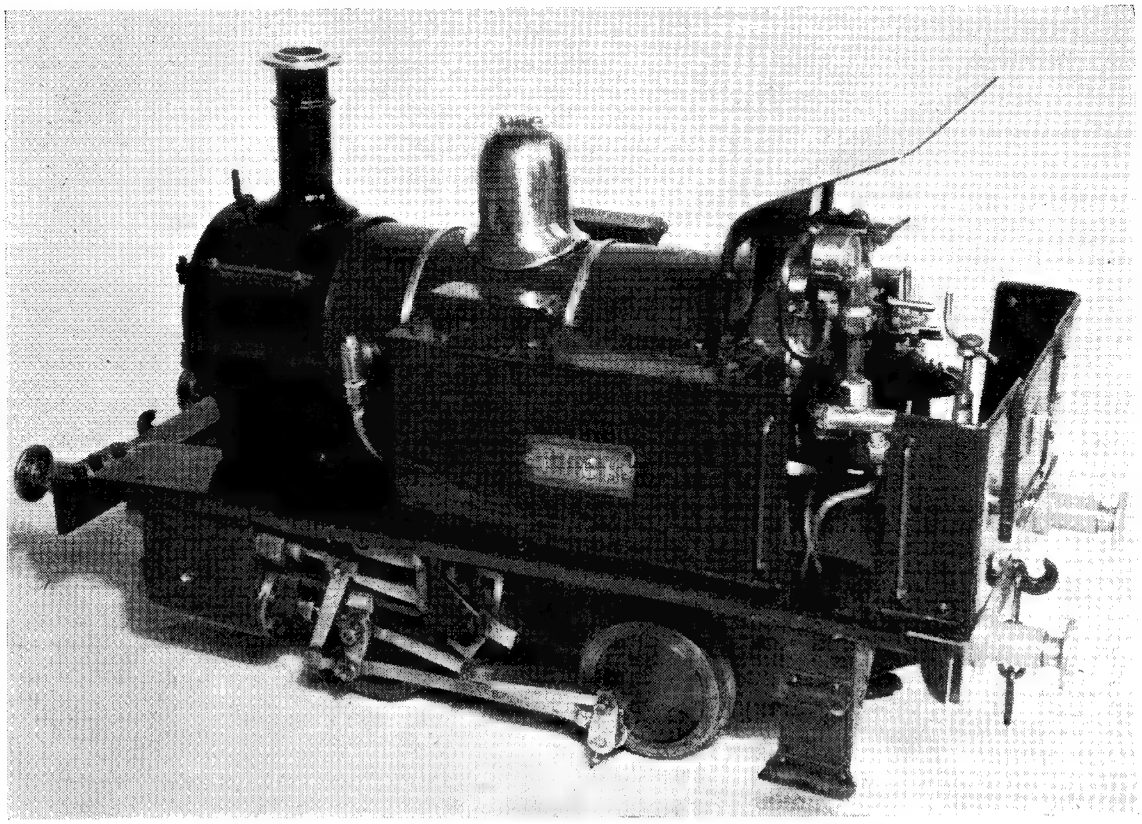
Since "L.B.S.C." first described *Tich* in these pages, one has seen an ever-increasing number of attractive 0-4-0 contractor's locomotives at various exhibitions, some built more or less exactly to the words-and-music, and some with additions and embellishments of the builder's own. One of the latter was J. H. Balleny's *Maid Marion*, which has taken him nearly two years to build. She has pulled two adults easily, and has done a mile non-stop with her driver only.

The machining and general finish were excellent, and so was the paintwork. This was done in ■ fairly dark royal blue Robbialac, which was allowed to dry naturally and then stoved in the gas-oven. Lining is in red, and with the shapely brass dome (complete with Salter safety-valve) and other brass work, the whole effect is delightful.

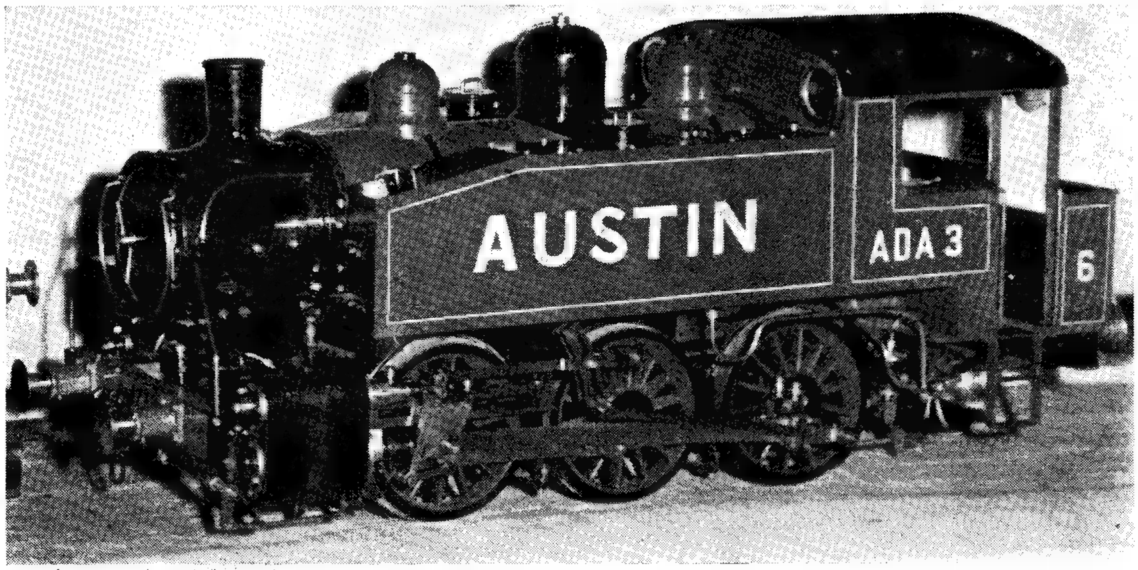
Other embellishments include fully compensated brake-gear, a quickly detachable bunker plate for ease of driving, and a ditto footplate for easy clearing. The footplate and steps have ■ raised diamond pattern, done with ■ diamond-shaped punch and plenty of patience.

Mr. Balleny, who is ■ member of the home club, is now building ■ G.W.R. "Dean Single," from Swindon drawings, and is collecting all the photographs of the prototype that he can. The bogie of his locomotive was on show, and seems

(*Continued on page* 43)



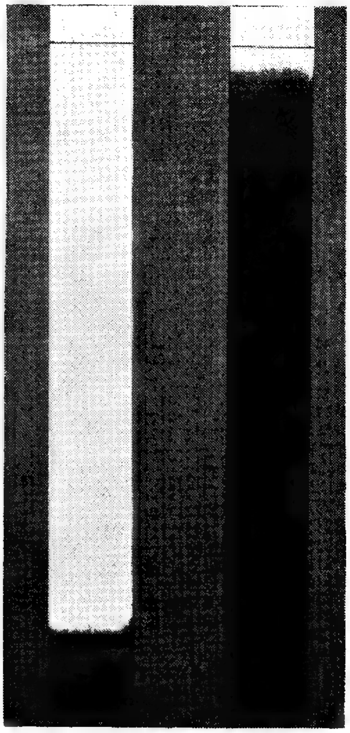
Another example of "Tich" is shown above, built by P. B. Barnes, of Coventry



A good example of a 5-in. gauge American locomotive, built by J. Strickland, of Rednal

Colloidal Graphite and the Model Engineer

By G. J. Bennington Davies



Two strips of filter paper, one of which (left) has had the end dipped in ordinary graphite-oil mixture. and the second (right) in "dag" colloidal graphite, showing how it is drawn up by capillary attraction

GRAPHITE is a crystalline form of carbon, and its well-known lubricating property is a result of the layer-like structure of the crystal. To obtain the maximum covering power and technical benefits from graphite, it is desirable that it should be in as fine a state of subdivision as possible. A practical method of reducing particle size below the lower limit of mechanically-ground powder is by the Acheson process of dispersing, wherein each particle of graphite is sub-divided into thousands of much smaller particles—small enough to pass readily through filter papers and to go wherever the liquid carrier spreads or penetrates. The manufacture of a colloidal dispersion confers on the graphite, a solid lubricant, all the desirable properties of a liquid lubricant without sacrificing the physical properties of the graphite itself.

When two rubbing surfaces are lubricated with colloidal graphite, the graphite, in effect, becomes a part of the surface metal, giving the surface the properties possessed by the graphite.

Colloidal graphite cannot be obtained in the dry state, but only dispersed in various carrier liquids. Of these, a dispersion in oil is the one of most interest to the model engineer. The "graphoid" layer which is formed as a result of rubbing colloidal graphite in oil over a metal surface confers on that surface very low friction characteristics. Furthermore this layer minimises seizure by preventing metal-to-metal contact in a bearing, and reduces wear considerably.

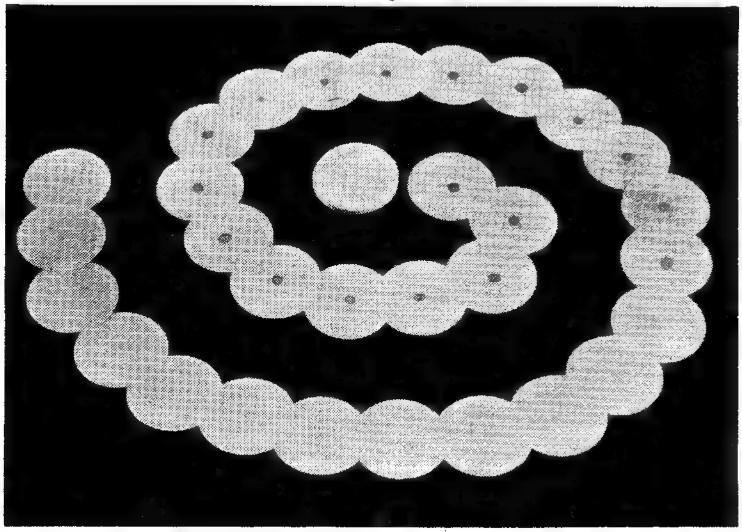
Once the "graphoid" layer has been established on bearing surfaces by the use of a colloidal graphited oil, it will be found that very much less lubricant is required than would be the case were a plain oil used alone. This property of colloidal graphite is invaluable when considering the lubrication of equipment for which it is desired that the minimum quantity of lubricant should be used. A particular example of this is the lubrication of air compressors, especially the sliding-vane type, when an oil-free air supply is required.

Uses for Colloidal Graphite

It is always desirable to run-in new mechanisms, including lathes and other machine tools, using a graphited oil as a lubricant. Not only will this procedure prevent "hot" bearings, but the bedding-down of the bearing surfaces will be completed in a smooth and gentle manner, without scoring and metal pick-up.

The presence of colloidal graphite in the fuel/lubricant mixture used in miniature compression-ignition engines gives higher r.p.m., and in the case of engines used in model aircraft, has prevented seizure when the propeller has for various reasons left the rest of the aircraft in a hurry.

Colloidal graphite is widely used in industry for the treatment of screw threads, subjected to high temperature conditions, to prevent seizure. Similar problems occur not



The penetrating quality of colloidal graphite demonstrated by placing a drop of it on the top layer of a pile of filter papers. No less than 28 papers show traces of graphite, though the half-tone reproduction does not enable this to be clearly seen

only in the model engineer's workshop, but also in the home. The electric iron that would not come apart, the blowlamp strap that could not be undone, that electric fire, the manufacturer of which used steel nuts and bolts that appeared, after a few months' use, to have been silver-soldered together.

These and many other problems of a similar nature can be minimised by the use of colloidal graphite.

Dispersions of colloidal graphite in oil are readily obtained at most stockists of motor accessories, under the name of running-in compound, graphited upper cylinder lubricant and graphited penetrating oil. Care should be taken to ensure that the container clearly states that the lubricant contains *colloidal* graphite.

How Colloidal Graphite is Used

Running-in compound contains the highest percentage of colloidal graphite, normally available to the motorist, dispersed in a medium viscosity mineral oil. It should be used as supplied, for the running-in of machine tools, and for the lubrication of gearboxes and similar equipment where the bearing loads are high. Where the lubricant is continuously fed to an engine on the "total-loss" principle, then about 2 per cent. to 5 per cent. running-in compound should be added to the oil normally used. Do not mix any graphited mineral oil with castor or similar vegetable oil, as they are not compatible. One or two oil companies do market, through stockists, small tubes of a colloidal graphite concentrate containing a higher percentage of graphite than that present in running-in compound. Apart from the uses recommended by the manufacturers, these concentrates are of particular value for screw thread treatment, and for bearings which can only be lubricated at very infrequent intervals.

Graphited upper cylinder lubricants contain less colloidal graphite than running-in compound, and usually employ a lower viscosity mineral oil. Furthermore, they frequently contain detergent and anti-oxidant additives, which are of value in engines of all types, especially those that rapidly form sludge and lacquer deposits. Graphited upper cylinder lubricant should be used for the continuous lubrication of high speed equipment. It has been found very suitable as a lubricant when cutting screw threads in a variety of different metals, using hand taps and dies.

The uses for a graphited penetrating oil are innumerable, the addition of the colloidal graphite giving dry film lubrication after the oil carrier has dried out or evaporated due to high temperature.

Colloidal Graphited Grease

Special greases containing colloidal graphite have for many years been available to industrial organisations, but it is understood that a special multi-purpose grease containing colloidal graphite will, in the near future, be available from retail factors. This will be a water-resistant medium consistency grease having a very high melting point, suitable for all types of grease lubrication. It is stated that this grease will lubricate from sub-zero temperatures right up to nearly 200 deg. C.

Typical applications for a grease of this nature are :—

Ball- and roller-bearings of all types and sizes.

Flexible drives.

Electric clocks.

Grease-lubricated reduction gear-boxes.

Plain bearings of all types, particularly those exposed to the weather or to high temperatures.

Metal forming operations of all types where grease lubrication is normally used.

Locomotives at Birmingham

(*Continued from page* 40)

to augur well for the finished job. Until recently the builder's workshop contained a 3-in. lathe but this has now been exchanged in favour of an M.L.7.

Another *Tich* was built by P. B. Barnes, of Coventry, but this was not so well finished as the other—the paintwork was somewhat rough, and there were file-scratches visible on the bright-work. Fitting, too, was not so well done; there was an appreciable amount of "slop" between the die-block and the somewhat curiously shaped curved link. The chimney and dome, too, were not too well shaped, and the latter not very well fitted to the boiler.

Two impressive G.W.R. locomotives were shown by H. and K. Richardson of Cheltenham; one was a "King" and the other a "Grange." The latter, built by H. Richardson, had a considerable number of countersunk screws visible, some holding on the cab roof, and foot-plate, and some on the wheel balance-weights. There were some file-scratches on the motion-work, which might easily have been removed, and some particularly bad scratches on the boss of the centre driving-wheel. Paintwork was only average, but there was a very neat G.W.R. coat-of-arms on the tender.

Similar remarks may be made about the "King," which was exhibited by H. and K. Richardson. Here, however, the cab fittings were very neat, with sliding coal doors and even the G.W.R. automatic alarm bell.

Another American Locomotive

In my preliminary report, I described H. Wilshaw's 0-4-0 American locomotive, which was built to 2½-in. gauge. J. Strickland, of Rednal, had built a 5-in. gauge 0-6-0 American locomotive of the ex-W.D. type, of which I understand the prototype is now working in the Austin motor works at Birmingham. This was a powerful-looking engine of typical appearance; the finish was very good on the whole, but was marred by file-scratches on parts of the valve-gear and in other places.

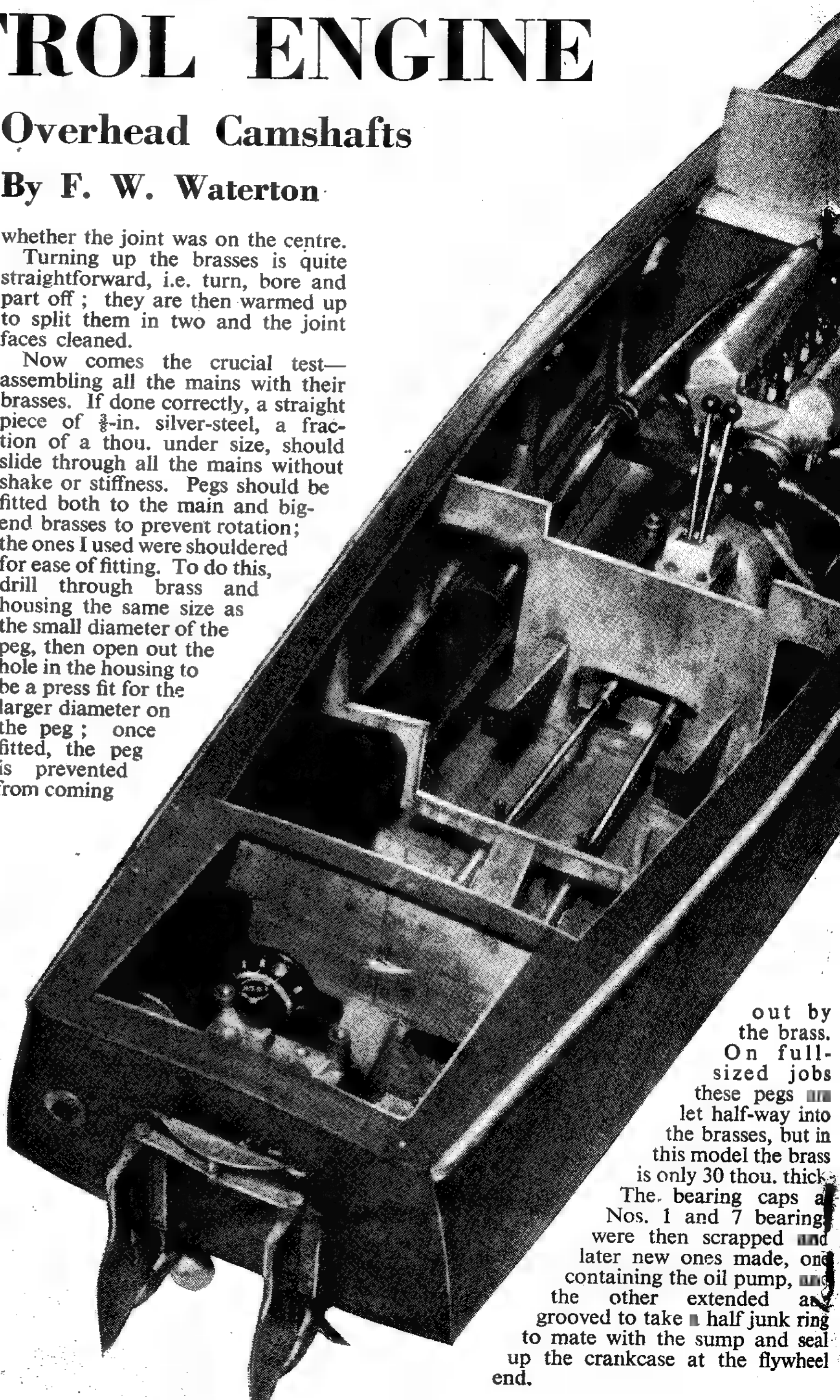
The backhead was neat, with sliding coal doors, and part of the cab backplate was removable for driving. Steam brakes were fitted, and a point of interest was the rather fancy-shaped lubricators.

Some other locomotives of interest included the "Halton" 4-6-4 tank built by W. H. Heaton, president of the Birmingham Society. This locomotive has run hundreds of miles and carried thousands of passengers; she was adding to this at intervals during the show. I also noticed the 3½-in. gauge. *Duchess of Buccleuch*," by T. A. Bott, of Oxford, with which he won the Championship Cup at the 1951 "M.E." Exhibition; another winner of a high award (at the 1946 "M.E." Exhibition) was the *Princess Marina* built by the late D. Picknell. There was also what is believed to be the oldest passenger-hauling model locomotive in existence, exhibited by C. Holme-Barnett, of Birmingham. This was a 1½-in. scale broad-gauge locomotive, probably of the G.W.R. "Aeolus" class, built by W. H. and G. Wilkinson in 1857. Can anybody beat this ?

A SIX-CYLINDER PETROL ENGINE

With Twin Overhead Camshafts

By F. W. Waterton



THE connecting-rods were machined from a piece of dural—actually, part of a propeller. They were profiled in the "Shapo-Miller" as one rod and then each rod was cut off the block with a circular saw. The same method served for the bearing caps. (See Fig. 12.) A small jig was then made, shown in Fig. 13, and this consisted of a piece of $\frac{1}{4}$ in. steel plate with a peg to fit the gudgeon-pin hole in the rods. This plate was mounted on the faceplate with the pin running true and each rod was clamped on to the plate, in turn one side out and then the other, to skim up the sides of the gudgeon-pin boss and to size the shanks of the rod. The 6-B.A. big-end bolts were made from H.T. steel bolts and the caps and rods drilled for them and the paired parts assembled. The jig was reversed on the faceplate so that the locating pin for the small-end brought the big-end centre in line with the lathe centre. The rod was clamped to the jig plate and the big-end bored and faced and so on for all six. The rods were then all faced on the second side. It should be noted that only one pass was needed on the second face and the saddle was not moved between rod changes; the thickness of the big-ends needed only to be measured on the first one.

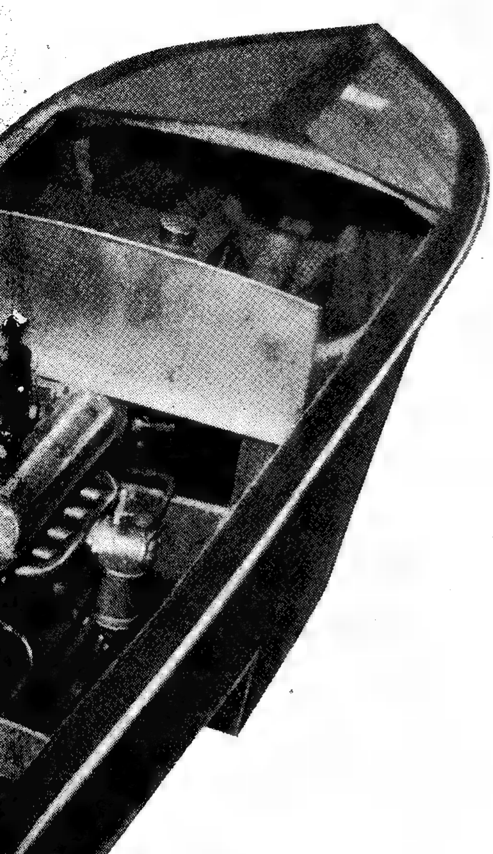
The jig was then fitted with a $\frac{7}{16}$ in. diameter peg to fit the big-ends by drilling and tapping before it was removed from the faceplate after completing the above operation. It was then used to hold the rods on the vertical slide while they were milled "H" section with a formed cutter made for the purpose from silver-steel rod. The brasses for the big-ends and the main bearings were then made from $\frac{5}{8}$ in. brass rod, split longitudinally with a circular saw, the faces cleaned up smooth and true and soldered together with a minimum of solder. This rod, now oval, of course, was chucked in the four-jaw. A trial skim across the end soon showed whether the joint was on the centre.

Turning up the brasses is quite straightforward, i.e. turn, bore and part off; they are then warmed up to split them in two and the joint faces cleaned.

Now comes the crucial test—assembling all the mains with their brasses. If done correctly, a straight piece of $\frac{3}{8}$-in. silver-steel, a fraction of a thou. under size, should slide through all the mains without shake or stiffness. Pegs should be fitted both to the main and big-end brasses to prevent rotation; the ones I used were shouldered for ease of fitting. To do this, drill through brass and housing the same size as the small diameter of the peg, then open out the hole in the housing to be a press fit for the larger diameter on the peg; once fitted, the peg is prevented from coming out by the brass. On full-sized jobs these pegs are let half-way into the brasses, but in this model the brass is only 30 thou. thick.

The bearing caps at Nos. 1 and 7 bearings were then scrapped and later new ones made, one containing the oil pump, and the other extended and grooved to take a half junk ring to mate with the sump and seal up the crankcase at the flywheel end.

Concluded from page 21, July 2, 1953.



The engine mounted in a twin-screw boat. A clutch and reversing gear have been incorporated to give adequate control

Timing Gear Train

The camshafts are geared together and turn inwards and are coupled to the crank through a train of gears. These were made from stainless steel blanks, all are 7/32 in. wide, 40 d.p., and were cut with home-made cutters as described some time ago in the "M.E." The gears for the oil pump, one 18-tooth, $\frac{1}{8}$ in. wide, and two 16-tooth, $\frac{1}{8}$ in. wide, were also made at the same time. Three 48-tooth and two 24-tooth or four 48-tooth are required for the timing gears, depending on the rotation chosen for the crankshaft. The intermediate gears run on stub shafts screwed to the end of the cylinder block and run on plain bearings. They get drowned in oil picked up from the sump by the 18-tooth oil pump driving gear.

Cylinder-Head

As already mentioned, the flat faces of the cylinder-head and port faces had been planed up earlier. The cylinder-head was fitted on its studs and the cylinder positions marked out through the bores. The head was removed and set up on the vertical slide, joint face towards the chuck, the hemispherical combustion spaces were machined out and finished with a form cutter. The plug holes were drilled and tapped at the same time; incidentally, the plugs are offset by 1/32 in. on one side of the centre line and the valves 1/32 in. on the opposite side. An angle-plate was made from $\frac{3}{8}$ in. material to support the head at the correct angle for drilling the ports and valve guide holes. These were all done at two settings, with the head on the vertical slide traversing the head from one cylinder to the next, doing all the inlets and then all the exhausts. The valve seats are bronze, inserted by screwing in and then machining up and finishing with a seating tool, when the cast-iron valve guides have been fitted.

The ports were drilled from the outside to meet the holes from the head, using a similar set up. The water spaces on the upper side were milled in with end mills and form cutters, again with the head on the vertical slide.

The Camshafts

These were made from 3 per cent. nickel steel case-hardened and ground to shape. The rockers were also hardened and the camshafts run in $\frac{3}{8}$ in. diameter cast-iron bearings and are immersed in oil baths. The object of this design was to obtain long and trouble-free operation without frequent adjustment even under hard usage.

The general scheme for forming the cams is shown in Fig. 14. A master cam *A* was made, eight times the size of the finished cam which is, of necessity, rather small, and mounted on a stub shaft and gripped in a collet. The cam is provided with a driving pin, *B*, whose function is to engage with one of the six equally spaced slots in a disc *C*, mounted on and keyed to the end of the camshaft, *D*. To machine the cam profile, a grinding wheel, *E*, is mounted on the cross-slide, which in turn is controlled from the leadscrew by a lever *F*. The leadscrew is used merely as a convenient pivot for transferring the motion supplied to the lever *G* by the master cam *A* to the top-slide via lever *F*. The two levers are clamped on to the leadscrew by Jubilee clips which close up the split bushes, on which they are mounted. The leadscrew was removed from the cross-slide and the position of the cross-slide fixed by an adjustable link *H*. The adjustment of the length of this link *H* controlled the cut of the grinding wheel. The radius of the end of the lever engaging the master cam is determined by multiplying the diameter of the grinding wheel by the ratio of the lengths of levers *F* and *G*, which is also the ratio between the sizes of the master cam and the actual cam.

The master cams were drawn out in the usual way, eight times the finished cam size, using a rocker also increased in diameter in the same ratio. The heels of the actual rockers are $\frac{1}{16}$ in. diameter and the top diameter of the cams is $\frac{3}{8}$ in. so that they will pass through the camshaft bearings.

The follower on the end of the lever *G* is held in contact with the master cam by a fairly strong tension spring.

When the camshaft blanks had been turned up and the above set-up assembled, the necessity for a steady at the cutting point was very obvious. To allow complete freedom of movement of the cross-slide, a steady was made in the form shown in Fig. 15, which consisted of two parallel bars supported at each end from brackets clamped to the bed and carrying an adjustable steady bearing which was arranged to bear against the journal nearest the cam being ground.

The camshafts were ground and hardened and then reground without difficulty except that in the hardening process, two were scrapped due to using unsuitable material which hardened right through on quenching. A small electric furnace was made to heat the shafts and this consisted of a piece of quartz tubing wound with the wire from an electric iron element. The tube was filled with case-hardening compound with the shaft in the centre and soaked at 770 deg. C. for one hour and then quenched in water. During the whole of the process, the camshaft was maintained in a vertical position to avoid distortion. The temperature was measured by means of a thermocouple and milli-ammeter.

The camshaft bearings and rocker bearings are built up from cast-iron bushes silver-soldered on to $\frac{1}{16}$ in. steel brackets as shown in Fig. 2. It was intended originally to bolt and dowel each bearing to the cylinder-head, but this proved impractical after many hours' effort. Finally, all the intermediate bearings were soldered to a 1/32 in. steel plate, which was trapped between the cylinder-head proper and the

valve boxes, after they had been lined up with a $\frac{3}{8}$ in. steel bar, also passed through the end bearings of the valve boxes. It might have paid to have made the valve boxes with a solid bottom and carved out the spaces for the valves and for the camshaft bearings. All the bearings could then have been bored at one setting with a long boring bar between centres.

The method adopted had one advantage over the above method, as it avoided drilling a $\frac{1}{16}$ in. hole through the rocker support brackets, which are spaced out over a distance of $5\frac{1}{4}$ in., as there is just no room anywhere to bolt them on afterwards without enlarging the head and it is on the big side at present. This hole takes the $\frac{1}{16}$ in. rods which are the rocker shafts and are pushed in from the flywheel end, each rocker being threaded on in turn. The rocker box cover prevents the $\frac{1}{16}$ in. rod from working out endways from the brackets.

The bearing bushes and rocker bearing holes were drilled and bored in a jig mounted on the vertical slide. On any future occasion, the $\frac{1}{16}$ in. holes only would be jig-drilled and the bushes rough bored under size, mounted on the steel plate as actually done, but then they could have been line bored *in situ* at the same time as the bushes in the valve box ends. I consider this procedure would have avoided the tedium of lining up the finished bearings and also have solved the difficulty concerning the drilling of the $\frac{1}{16}$ in. holes for the rocker bearings. However, after many weeks of patient fiddling, the job was completed to my satisfaction, and now after a few hours' running, these shafts run very smoothly and with very little friction considering the number of bearings involved. It might have been satisfactory to reduce the number of bearings to four, but as they would have then been nearly 2 in. apart on a $\frac{3}{16}$ in. shaft with two cams between, I was a bit dubious about possible flexure and decided on seven bearings.

The rockers were roughed from $\frac{1}{8}$ in. mild-steel plate drilled $\frac{3}{16}$ in. diameter for the eccentric bearing bush and mounted on a $\frac{3}{16}$ in. bolt and soldered together into a block. They were then shaped as one on the "Shapo-Miller," the ends being cut to the required profile by form tools made from silver-steel pieces

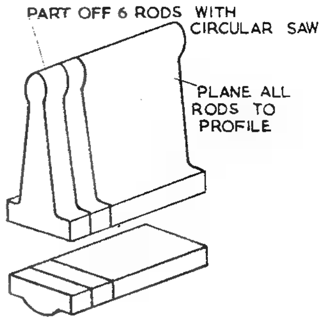


Fig. 12. Method of making rods

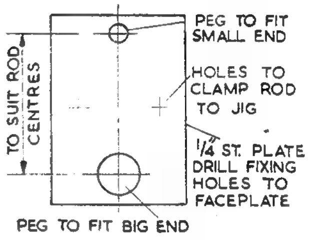


Fig. 13. Jig for machining connecting-rods

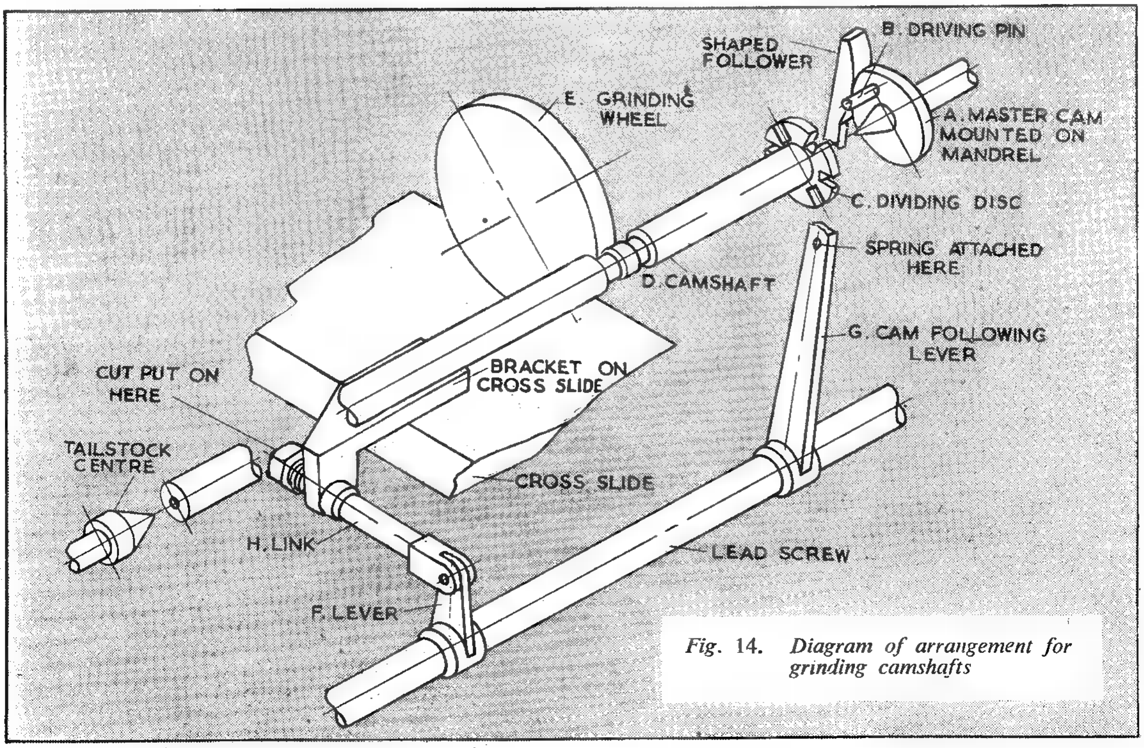


Fig. 14. Diagram of arrangement for grinding camshafts

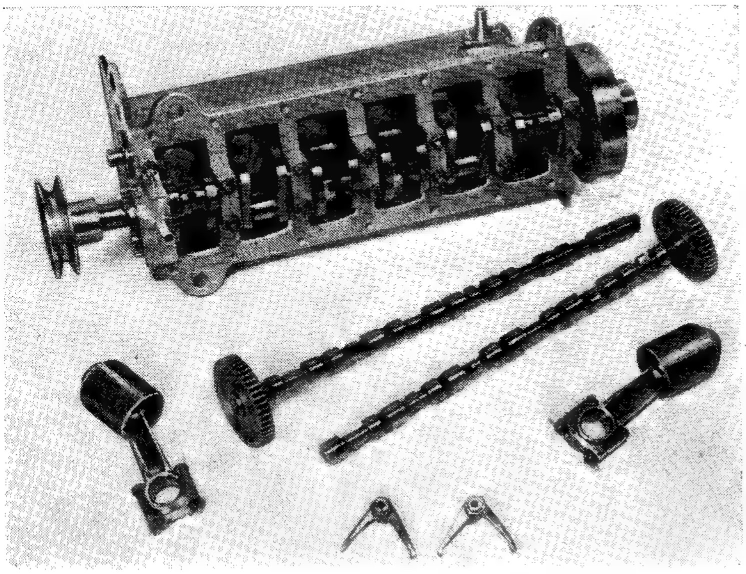


Fig. 16. Some of the main components

bearing caps are held on by castellated nuts and locked with 1/32 in. split pins. The slots in the nuts were put in by milling them in batches of eight, the nuts being held in a slot in a piece of brass by 6-B.A. screws from the underside. The holes were spaced so that the nuts wedged each other and so prevented them from turning while the slot in the bar which fitted the nuts across corners prevented sideways movement. Each batch of nuts were set up in the slot three times to cut the six notches.

Looking back over these notes, I feel that there are many things I have left unwritten and only the bare bones of some of the operations on the components have been mentioned. To describe them in detail would take more time than I have available, but I hope that the several people who have written to me for plans, castings and instructions will find them sufficiently complete to enable them to build the engine and help to save them some of the headaches I experienced.

If they are as pleased as I was the first time the engine ran, their patience and trouble will be amply rewarded.

silver-soldered on to mild steel shanks. The cam end is a $\frac{1}{16}$ in. diameter semi-circle and the valve end a sector of a $\frac{3}{8}$ in. diameter circle. The profiles of these form tools were made by drilling a piece of carbon steel (toolmakers', ground flat) with a drill to give the required diameter to the tool at an angle of about 10 deg. to the surface, sawing out the pieces containing the hole and silver-soldering them to the shanks, and afterwards the parts not required were ground away and the cutting edge sharpened. The main engine components are illustrated in Fig. 16, and include the camshafts, rockers, crankshaft, pistons and rods.

As mentioned previously, the first water pump was too small. The second was made from a pair of $\frac{1}{2}$ in. Meccano gears with the tops of the teeth skimmed off and the centres reduced to 0.475 in. This treatment removed most of the backlash and, after fitting in an aluminium body with bakelite side cheeks and bearings, gave excellent results.

Valves

These were turned from the shanks of some diesel engine valves. The shanks are 3/32 in. diameter and the heads $\frac{5}{16}$ in. across. The springs are retained by split cotters, which are 0.074 in. bore by $\frac{1}{8}$ in. o.d. $\times$ $\frac{1}{16}$ in. long; they fit on a reduced diameter near the end of the valve stem and drop into the usual recess in the spring retaining caps. The valves were ground in by applying a tension load with a pin chuck from the outside end. The seatings were finished using 4 F. carborundum powder.

One further item which may be of interest—the big-ends and main

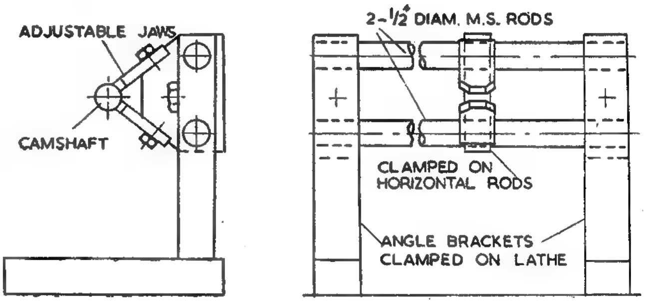


Fig. 15. Steady for grinding camshafts

FOR THE BOOKSHELF

Metal Turning Made Easy, edited by Eric Franklin. (London: Cassell & Co. Ltd.) 160 pages, size 5 in. by $7\frac{1}{2}$ in. Price 4s. 6d. net.

This book sets out to explain in detail the operations of turning, boring and screwcutting in the lathe, and is intended to be of use primarily to the amateur novice and the unpractised owner of the small workshop. The editor has succeeded in collecting together much helpful information fully illustrated by half-tones and diagrams.

The text is written in simple style and is easily understood; but there is some evidence of rather hurried editing. On page 13, we note that, in the reference to the use of V-blocks and a surface gauge for finding the centre of a circular piece of work, four scratches are specified, whereas only two are necessary. The blocks of Fig. 52, page 43, and Fig. 133, page 95, are manifestly transposed. Such slips apart, however, the book should appeal strongly to those for whom it has been compiled.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with :

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked " Query " and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Slide and Strip Projectors

I am interested in the making of optical projectors, and would like to construct the slide and strip projector described by " Kinemette " in the issue of THE MODEL ENGINEER *dated March 2nd,* 1950. *Can you tell me if castings for the construction of this projector are available, and if so, how much it would cost to construct the projector ?*

E.H. (Eastbourne).

The slide and strip projector to which you refer was intended for miniature slides, single-frame and double-frame strips, and was not made from castings, but was built up from sheet and other stock material.

A second projector described in the same series, however, and intended only for use for single-frame film strips, was made from castings, and these can be obtained from Roox Products, Wellhouse Road, Beech, Alton, Hants.

We regret that we cannot advise you how much it would cost to construct a projector.

Model Shell-firing Gun

I wish to build a model shell-firing gun, but I have not been able to get any suitable drawings. Can you give me any assistance in this matter ?

B.W. (Birmingham, 23).

An article on a " Quick-firing Naval Gun " appeared in the issue of the " M.E." dated January 27th, 1944 ; another article on a modification of the [illegible] gun appeared in the May 8th, 1947 issue, and one on " Building a Model Naval Gun " in the issue dated April 14th, 1949.

Lamp Resistance

I have a small ex-Government two-pole universal electric motor of about $\frac{1}{8}$ *h.p. running on* 220 *volts at* 2,800 *r.p.m. which is used to drive a window display, geared down to approximately* 175 *r.p.m. As I wish to run the display at not more than* [illegible] *r.p.m. and there is no room for any further reduction gearing, I am using four* 100-*watt lamps in series with the motor, to obtain a further reduction to about* 24 *r.p.m. I wish to use the lamps in the illumination of the display, but I find they only give a very dull glow, and I should be grateful if you would advise me how to obtain the desired results by using the source of illumination, on a normal domestic supply of* 220 *volts, to reduce and control speed of the motor while obtaining at least* 75 *per cent. of the total strength of illumination, and also attaining the desired motor speed.*

J.H. (Hull).

The use of lamps as a series resistance for lowering the speed of an electric motor is not a highly satisfactory method, and in cases where lamps of the normal supply voltage are used as a resistance, there is bound to be some decrease in the brilliance of illumination, owing to the fact that the motor resistance must necessarily lower the voltage across the lamp circuit. The only way in which lamps could be run at full brilliance under these conditions would be to test the actual voltage drop across the lamp circuit when the motor is working, and use lamps of that voltage, but with a resistance equal to that of the lamps you are now using.

We cannot give you the figures for either voltage or resistance, as we do not know the resistance of the motor or the amount of current that it uses when run under the conditions described.

Petrol Engine Accessories

I have constructed a model o.h.v. petrol engine of 1 *in. bore,* $1\frac{1}{2}$ *in. stroke, and now wish to make the coil ignition equipment and carburettor for it. Please inform me where I can obtain particulars or drawings.*

E.B. (Birstall).

The subject of coil and magneto construction for small engines is dealt with in our handbook *Ignition Equipment*, which is obtainable from our publishing department, price 8s. 6d.

With reference to carburation, several designs of carburettors have been published in THE MODEL ENGINEER and we can supply blueprints for the following :—

P.E.8 : Atom Type " R " Carburettor, price 2s. 9d. ; P.E.12 ; The Kiwi Automatic Carburettor, price 2s. 9d. ; P.E.15 ; The Apex Minor Automatic Carburettor, price 2s. 6d.

Any of these carburettors could be adapted to suit your engine. We would suggest that the throat diameter of the carburettor should be about $\frac{5}{16}$ in. to $\frac{3}{8}$ in. diameter for engines of the size specified.

Cycle Speedometer Attachment

I wish to make a gear ring for driving a speedometer from the front wheel of my cycle. The gear ratio required is 29 : 11 *and I have already made a mild-steel gear ring, which is now showing signs of wear, and replacement is indicated. Would it be possible to obtain bevel gears of this ratio, or an alternative system that transmits the drive through a right-angle, such as a multi-start worm gearing ? I should be grateful if you could also inform me where to obtain a lighter flexible drive than is normally supplied for this purpose.*

F.W.N.S. (Mirfield).

We regret that we cannot advise you of anyone who can supply ready-made bevel gears to produce a ratio of 29 : 11 or the alternative ratio of 8 : 3 which you suggest.

Our experience is that the gears used for cycle speedometers are generally satisfactory, provided that the gear ring is properly trued up when fitting. Your mild-steel gear ring would undoubtedly have given much better wear had it been case-hardened before fitting.

While bevel gears would give a very satisfactory drive, it should be noted that the adjustment of gears of this type is generally more critical than that of spur gears, and we doubt whether the wear would be any better unless the gears could be enclosed and properly lubricated.

A multi-start worm gearing would also be suitable, but the worm would have to be of fairly large diameter in order to adapt it to a cycle hub. We regret that we cannot advise you where to obtain a lighter flexible drive than that generally employed for instruments of this type. The lightest type of flexible drive we know of is that used for driving dental tools, but we cannot say definitely whether this would be suitable for the purpose you have in mind.

Institution of Mechanical Engineers

● CORONATION EXHIBITION OF MODELS

AS the climax of its Coronation week activities, The Institution of Mechanical Engineers held a Conversazione. This function, which was attended by some 200 members and their ladies, was held on the evening of Friday, June 5th, at the Institution's delightfully - situated headquarters at the corner of St. James's Park, right in the heart of the Coronation splendour. Now, ■ conversazione lends itself to all kinds of things besides conversation, and in this particular case the entertainments varied from dancing in the magnificent library room to a continuous performance of films.

However, the centre of interest at the conversazione, from THE MODEL ENGINEER readers' point of view, was an exhibition of models in the Institution's council chamber. This was no ordinary exhibition. It consisted of a collection of some of the gems of recent " M.E. " Exhibitions, and the mustering of such an array would appear to be a quite prodigious task. However, with the willing aid of the " M.E." Editor and Exhibition Manager, approaches were made to about a dozen of our finest modellers in various fields. The response was amazing. Almost without exception, these remarkable people went to considerable trouble to deliver their models to the Institution.

The result was well worth the trouble which was taken, from everyone's point of view, for the models found ■ measure of appreciation which would be difficult to surpass in any community. Most professional engineers are too hard pressed in these days to be able to spend much time on modelling themselves, but there must indeed be few among them who do not appreciate a fine model when they see it.

The exhibition was not intended by any means to be all-embracing, but everyone was too busy admiring the wonderful pieces that were there to miss those models that might have been included. It is just impossible to say which of the exhibits got the most attention, but Mr. F. H. Buckley's " P " type M.G. car was an obvious favourite with the ladies. The fact that the lights, horn and trafficators all worked seemed too much for them to take in. The menfolk certainly went for Mr. G. C. Taylor's $1\frac{1}{2}$-in. scale Fowler Compound Showman's engine, and no wonder, for it is most certainly a champion in its class, as readers who were at last year's " M.E." Exhibition will be well aware. In the bright lights of the council chamber, Mr. Taylor's model certainly shone like one of the Crown Jewels. And how appropriate that she bears the name *Elizabeth* ! As an added interest, a large photograph of His Royal Highness the Duke of Edinburgh, taken while he was admiring the model last October, was displayed.

On the ship-modelling side, Mr. F. A. A. Pariser's cup-winning sloop *Echo* formed an impressive centrepiece. The builder, who brought his model all the way from Birmingham especially for this display, and braved Coronation week traffic to do it, thoughtfully brought a couple of the original Admiralty plans along with him, and these were artistically " scrolled " on each side of the baseboard ; however, it was not long before they were being " unscrolled " and avidly studied in comparison with the model.

Ship miniatures were not forgotten, and who better to be called upon than the famous McNarrys ? Donald was represented by his *Caronia* (*Coronia* might have been ■ better name for the occasion !) and by that small but scintillating gem, the *Prince*, a timbered and planked Navy Board model of ■ first-rater,

(*Continued on page* 56)

Chartered Mechanical Engineers and their guests admire a fine selection of models

L.B.S.C.'s Lobby Chat

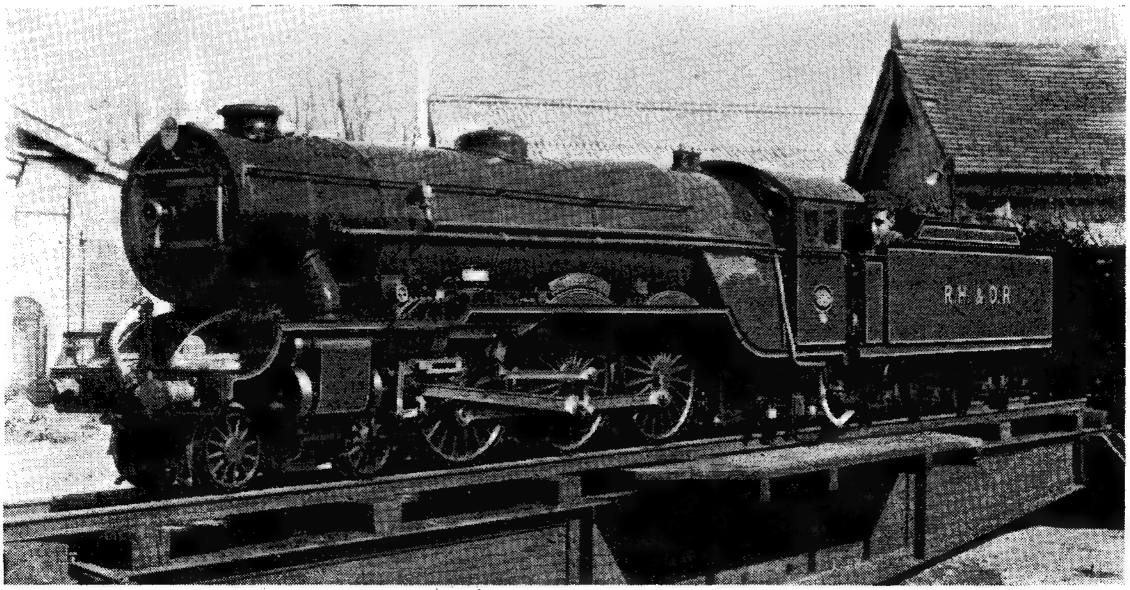
PERFUMED LOCOMOTIVES!

SEVERAL readers have written to ask if somebody has been pulling the august leg of the B.B.C. on a point of locomotive design. It appears that in a recent Sunday quiz, the question was raised as to whether it was the practice to put a bag containing essence of violets in all bearings of a modern locomotive that were liable to run hot; and were the drivers instructed to stop and examine the bearing immediately they got a sniff of the perfume, indicating that a bearing had warmed up and released the essence? The answer was yes; and one of the quiz team added that aniseed was sometimes used. One correspondent says that he has been in the engineering business for 49 years, and as he has never heard of such a thing before, is he so far behind the times, or is it just a lot of old boloney?

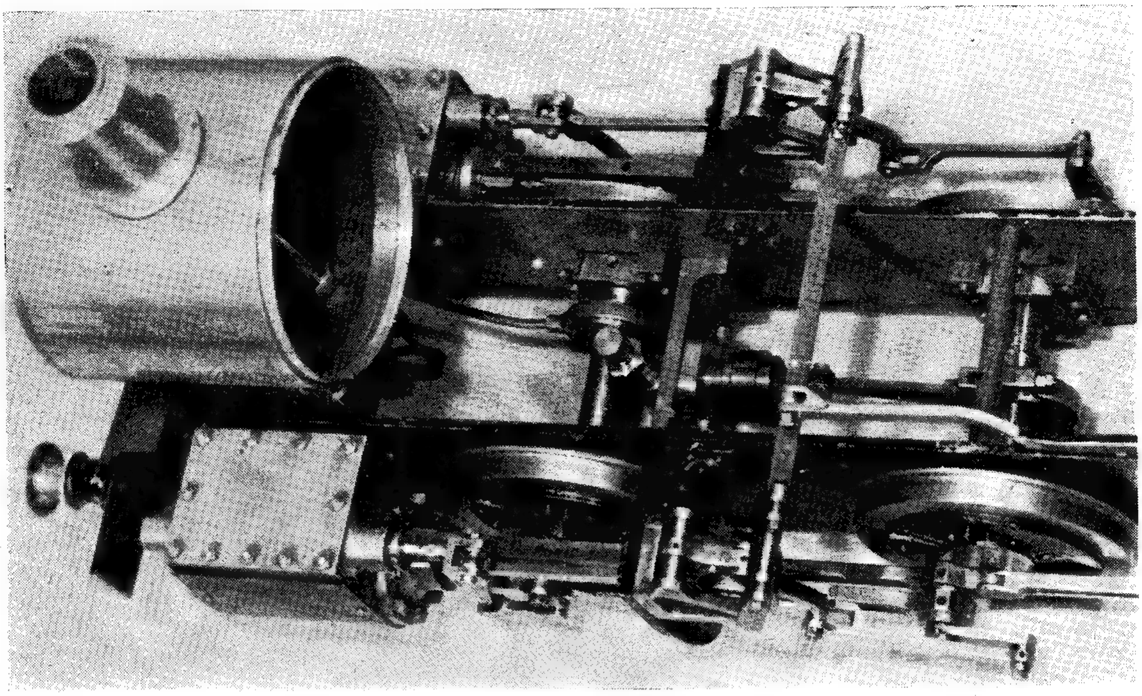
As in other instances, when non-technical folk start in to "explain" things, they get their facts all garbled up. The quiz team were no exception, so if I give the correct explanation, it will set our readers' minds at rest. There was no leg-pulling. As is well known among the full-size locomotive fraternity, considerable trouble was experienced with the inside big-ends on the Gresley Pacifics during the early days of the "ground flying machine" trains. The two-to-one conjugated valve gear which operated the valve of the inside cylinder, was the primary cause of the trouble. The rods whipped at high speed, causing the valve to over-run, thus having a greater travel than the valves of the outside cylinders. Consequently the inside cylinder did much more than its fair share of the work, and the big-end "copped out," as the kiddies would say. The big-end casualties on the trial runs were just nobody's business; and not only big-ends, but in more cases than one, the cylinder covers were fractured. I remember *Seagull* arriving at Kings Cross on one occasion in such a terrible state, that it was a wonder the poor bird flew home!

The drivers said that the super-high-speed, and the row that the engines kicked up, prevented them from knowing that anything was going wrong underneath, in time to stop and avert a casualty. On the L.B. & S.C. Railway most of the drivers developed "dogs' noses," and could detect the sniff of a hot box or big-end, long before it got bad enough to "run out"; but our engines didn't run quite as fast as the "ground flying machine," nor were they anything near the size of the Gresley Pacifics. We had an occasional hot trailing or tender box, but it was seldom indeed that a Stroudley-type big-end gave trouble. The marine-type brasses were "scraped" with a file, and the scratches left in, to hold the oil; they ran from one year's end to another without attention, provided the driver looked after the oiling. Rape oil was used for them, with loose plug trimmings.

Anyway, something had to be done about the Gresley big-ends, so it was decided to fit them up with



The "Romney's" first hot steamer



Mr. G. Dainton's " P.V. Baker " with variations

" tell-tales " in the shape of a glass "stink-bomb" containing amyl-acetate. Anybody who has worked with celluloid, won't need telling what amyl-acetate is, as they use it for dissolving celluloid, and for making cement for the material. It gives off a very pungent and penetrating odour of " pear-drops " —those boiled pear-shaped sweets that could be bought for 2½d. per lb. when I was a kiddy. There were other kinds of sweets that I liked much better; but six ounces for a penny was a temptation that couldn't be resisted ! Well, the stink-bombs were duly fitted; and as soon as a driver got a whiff of " pear-drops," he knew that the inside big-end had either had it, or jolly soon would have it, so he eased up, and got a relief engine as soon as possible.

I have never heard of essence of violets, aniseed, or anything else being used; I don't think amyl-acetate could be beaten for the stink-bomb caper! I remember once, when my old dog was alive, I was mending a celluloid accumulator case for a friend. Old Mick was a proper " nosey-parker," always wanted to investigate what was going on, and would jump up on the chair, put his paws on the bench, and take a good look all around. On this occasion he took a good sniff at the uncorked bottle of amyl-acetate; and, oh boy ! —*did* he jump down quickly. He sneezed about fifty times nonstop, I thought he would break his neck, the way his poor old head kept bobbing up and down. It was funny, but I really hadn't the heart to laugh, and when he got over the atishoo fit, I gave him a few sweet biscuits (his weakness) as some consolation. Once when out on the car with me, he had a similar experience when we got in a traffic jam behind a diesel bus. I didn't feel too good myself, after inhaling some of the fumes from the exhaust pipe of the bus; much prefer good honest coal smoke !

Superheating a Crampton Locomotive

The excellent series of articles and drawings by Mr. E. W. Twining which appeared in recent issues, on full-sized Crampton locomotives, has brought some queries concerning the possibility of an internally-modernised version of one of these in the small size. I have replied to several correspondents direct, on specific points to ensure efficiency; and if there are enough interested readers, and the Knight of the Blue Pencil doesn't raise any objection, I would gladly describe a hotted-up small edition of, say, *Liverpool*, as a short serial to follow the *Titfield Thunderbolt*. Meanwhile, there is one query which I could deal with here; it is asked how a superheater could be arranged on a Crampton, without upsetting the existing outside pipe arrangements, and spoiling its personal appearance. In full size, the regulator box is mounted on the barrel, and pipes go down to the cylinders from this, on each side of the boiler. The exhaust pipes go from the cylinders to the smokebox, along the side of the boiler. Any addition to this bit of plumbing, says my correspondents, would be akin to adding breeks to a Scotsman's kilt, so what about it ?

" Simple, my dear Watson," says Curlylock Holmes. What I should do, if I were building a Crampton, would be to fit the regulator box as shown, but connect it to an internal pipe going to the smokebox tubeplate, leaving on the outside pipes as dummies. A superheater of the multiple-unit type would be fitted, with headers in the smokebox, which would be extended back as far as the first boiler band, by the simple expedient of setting back the smokebox tubeplate to that amount. The outside appearance would be unaltered. Steam could then be taken from the hot header to the cylinders, by what would

be the exhaust pipe on the full-sized engine. An actual exhaust pipe could be taken from each cylinder, between it and the boiler (out of sight) to a tee-piece under the boiler barrel. From this, a pipe could be fitted along the bottom of the boiler, out of sight, as it would be hidden by the frames. This would extend to an elbow directly under the bottom of the smokebox, in line with the chimney; and a blast-pipe screwed into this, through a hole in the bottom of the smokebox, would complete the job.

Other Superheater Queries

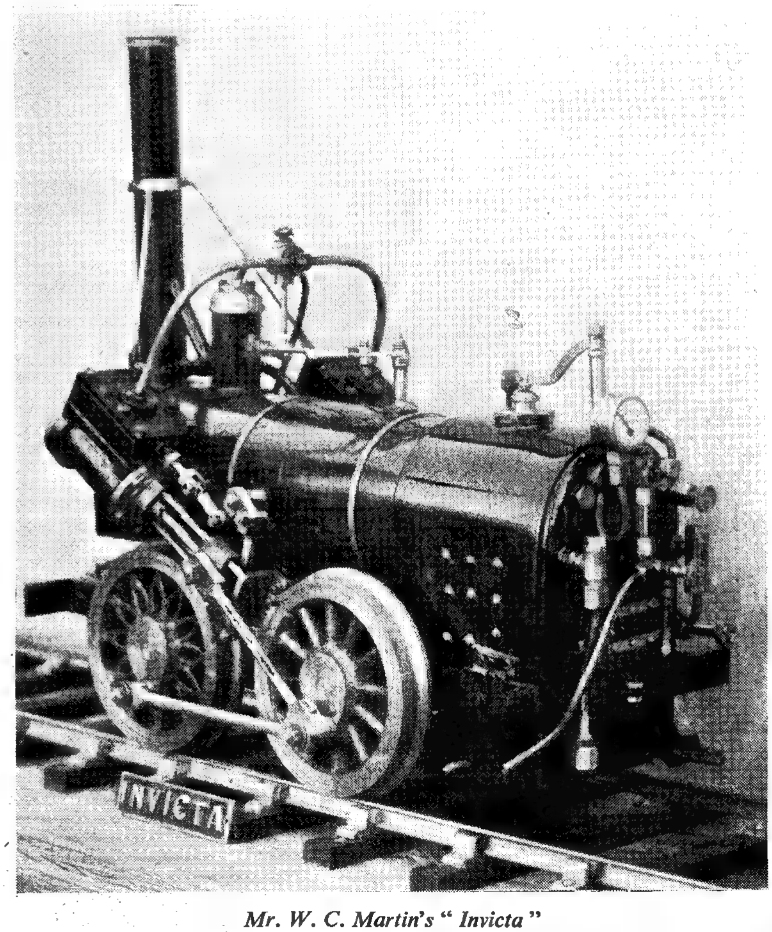
Beginners have asked why I discarded spearhead elements for block bends. It was to make matters easier for those very beginners, that I changed over. The trouble was, that inexperienced tyros would persist in putting so much brazing material on the spearheads, when making the oval joint, that it ran inside and partially blocked the thoroughfare. This, of course, throttled the steam supply; and naturally the engine wouldn't perform in the way usually expected from engines described in these notes. They never suspected the reason, until it was pointed out. A properly-fitted block bend can't very well be choked with brazing material, if the pipes fit reasonably close in the end drilled to receive them.

Another reason was, that on small boilered engines which need a fierce fire to maintain full working pressure, and on locomotives with a heavy blast due to worn valve-gear or other causes, ash, grit, and small cinders are drawn through the superheater flue, with a kind of "sand-blasting" effect on the spearhead. The erosion of the metal finally results in either pinholes forming, or even a burst. The greater thickness of metal in the block bend, naturally enables it to withstand the scouring action to a far greater extent, and failures are few and far between. However, there are no objections on that score to spearheads in a boiler with a combustion chamber. Several of my own locomotives have these, and they have given no trouble. One thing in favour of spearheads is, that there is less liability of "birds' nests" forming against the sharp tip, than against the solid-ended block bend, which encourages stuff to pile up against it when the blast is heavy.

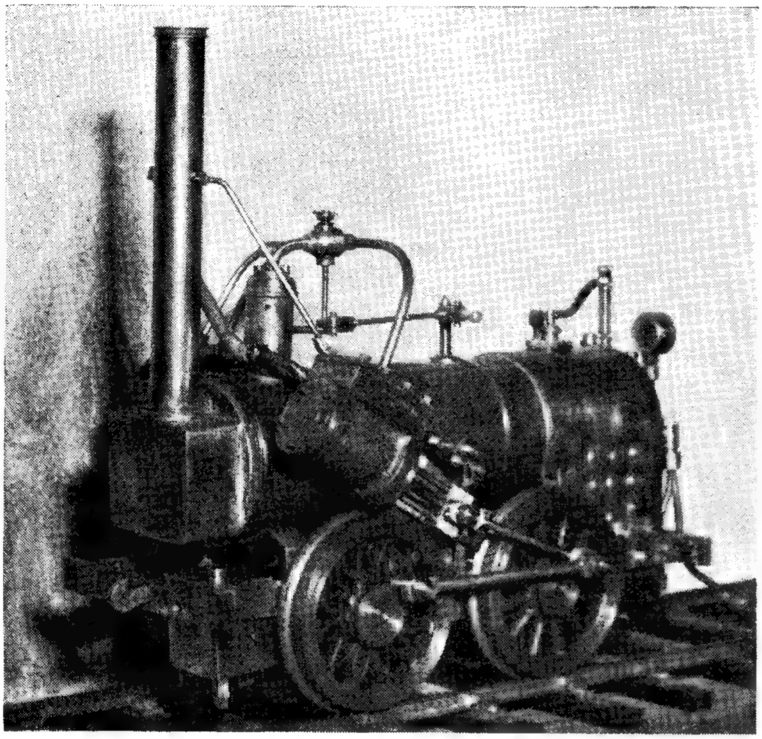
Another beginners' query is, why not put the legs of the elements in separate tubes, and have a loop in the top of the firebox, instead of a spearhead or block bend in a separate flue? If made of copper, it would soon burn, and eventually burst. If made of steel, the inside would scale, bits would flake off, go down to the cylinders, and do the valves, bores, and pistons what the kiddies call "a bit of no good." Another beginner wanted to know if the single-flue Alexander boiler would work all right with a coal-fire, and could the loop superheater be used with it? I wouldn't recommend it for use with a coal-fire, although it was all right with spirit, as the efficiency would be very low. There would be such a big core of hot gases going through, that the smokebox would probably overheat, and the paint burn off it. I have seen this happen with locomotive-type boilers with too large diameter tubes. There would certainly be plenty of superheat, as the loop would be right in the hottest part of the core; and incidentally, whatever anybody may say, or whatever arguments may be put forward as to the origin of the firetube superheater, there is no getting away from the fact that my steam-drying loop in the Alexander boiler of half-a-century ago, was the great grand-nanny of the type of firetube superheaters that we now use. I have so far been unable to trace any *authentic* information about anybody else fitting a similar type at the same time. Claims, yes, in plenty; *but no definite proof.*

Hot Steam on the R.H. & D.Ry.

Before leaving the subject, it is interesting to note that the Romney, Hythe and Dymchurch Railway have at long last gone in for hot steam. The original L. & N.E.R.-type Pacifics were designed by the late Mr. Henry Greenly, and the specification called for a "gridiron" in the smokebox. This was found to be more of a condenser than a superheater, and they were soon removed; since when, the engines



Mr. W. C. Martin's "Invicta"



Early designers didn't bother about neatness!

have run on "wet" steam. As a result of this, the coal and water consumption has been pretty high, so a proper firetube superheater has been tried on the engine illustrated, which was photographed by C. J. Grose. I understand it has given excellent results, but at the moment I have no details either of the job itself, or of the increase of efficiency obtained. However, I hope in the very near future, to take an evening run on the gasoline buggy, as far as New Romney, to pay my respects to the Barlow family; and I expect foreman-driver George of that ilk, will be able to spill all the beans—so more anon!

"P.V. Baker" with Variations

The reproduced photograph from an "upstairs viewpoint," shows part of an 0-6-0 tank engine, based on my *P.V. Baker* design, in which the builder, Mr. George Dainton, of Southport, Lancs, has introduced some variations. Slide-valve cylinders are fitted in place of the specified piston-valves, and there are two extra stay-rods between the frames, located over the driving and trailing axleboxes. No horn-blocks are fitted, but separate cheeks are riveted at each side of the axlebox openings. Incidentally, I don't favour this method unless the frames are very deep over the axlebox openings as the latter weaken the frames. The usual type of horseshoe horn-block counteracts this, by virtue of the stiffening piece over the axlebox opening, which acts as a good reinforcement over the weakened part of the frame.

The pump is fixed to a separate flange bolted to the pump stay, and is readily detachable, something after the arrangement that I specified for the pump on *Britannia*. The Baker valve-gear is reversed in a different way from my usual specification, as the reverse yokes are cross-connected by a bar, to which the reach-rod is attached. Whilst this may be all right for a small locomotive, it wouldn't do for a full-sized one, as the bar would bend under the stress, and eventually break. The old single reverse yokes were very good at breaking, which is why the double yoke was adopted. Even in the small size, there is a likelihood of the right-hand set of gear getting "out-of-step" with the left-hand side, owing to the spring of the bar; so personally, I would definitely prefer the usual arrangement with separate reach rods. The pole lever in my specification has been replaced by a wheel-and-screw, the screw being ¼ in. diameter with a ten-pitch left-hand square thread, with nut to suit. It takes nine complete turns to reverse the engine. She goes very well on air pressure, and has plenty of power. Friend Dainton deserves extra credit for the excellence of his craftsmanship, for—like your humble servant—he is well along the main line of the Great Railroad of Life.

Up—the Invictas!

Many of the little *Invicta* locomotives are now approaching completion, and some have already been in steam, with much satisfaction to their builders. Two of the earliest to be completed, as far as the engine part was concerned, were those made by Mr. S. Reeves, of Bracklesham Bay, and Mr. W. C. Martin, of Mildenhall, Suffolk. Pictures of Mr. Reeves's job have already appeared; Mr. Martin's engine is shown in the accompanying reproductions of photographs taken by "Studio 5." He started to run "ahead of schedule" towards the finish, hence the different arrangement of exhaust pipes, and other variations from the instructions. She is a nice job, and is Mr. Martin's second locomotive, his first being our old friend *Tich*, which also proved a winner.

Suggestion for Tender Pump

A garage handyman who is building a L.S.W.R. "Greyhound" suggests making the tender hand-pump like a double-acting Smith "Jackall" pump, as used on cars equipped with Smith hydraulic jacks. This consists of a die-cast box with two opposed pump barrels at the bottom. The single ram is slotted at the middle, to take the end of a short lever on a spindle projecting through side of box, operated by detachable hand lever. On suction stroke, ram uncovers a slot in barrel, through which fluid enters, and is forced by ram through a distribution valve, to front or rear jacks as required.

There is no objection to making a tender hand-pump on same principle; but being only for emergency use, delivery on both strokes is of no great advantage. The drawback of "one-valve" pumps, is that if the valve leaks—a not exactly unknown happening—the ram is forced to the end of the barrel, steam and hot water then comes through the open inlet slot, lowers level in boiler, and heats contents of tender tank.

TOOLMAKER'S CLAMPS

By "Duplex"

SMALL parts quite often have to be clamped together for drilling and the assembly is then gripped in the machine vice.

Toolmaker's clamps are most convenient for this work, and they should be large enough to afford a secure hold without getting in the way and keeping the work from seating properly in the vice.

For small work, we use a Myford machine vice on the drilling machine table, and the floor of this vice stands $\frac{5}{8}$ in. above the under surface of the base; this means that any toolmaker's clamps used should preferably measure less than this dimension from the jaw face to the top of the setting-screw.

Where this dimension is exceeded, either the work or the vice itself will have to be raised on packing strips if the head of the screw is to be kept clear of the drill table. However, packings are always a nuisance, and are liable to introduce errors in setting up the work.

The smallest Starrett clamps in the workshop have jaws only $\frac{1}{4}$ in. in width, but the head of the setting-screw projects for $\frac{11}{16}$ in. beyond the jaw face. The head of the screw could not be reduced in length without cutting into the tommy hole, and as the screw had a bastard thread, it was not worth while making a new part. It was decided, therefore, to make a pair of special clamps, suitable for use with the machine vice, and so save all further trouble with packings.

Several examples of different makes of toolmaker's clamps were measured up, and it was found that their proportions greatly varied, but the dimensions given in the accompanying Table would appear to be conventional.

Making the Jaws

The special clamps were made to the dimensions shown in Fig. 2, and the jaws are made either from mild-steel and afterwards case-hardened, or tool steel may be used, and finally hardened and tempered. As it is important that the faces of the jaws should be flat and square, great care must be taken if the parts are finished by filing; but it will usually be found easier to machine the jaws by milling or fly-cutting or, even better, to do the job in a small shaping machine.

Time will be saved if the jaws are marked-out and machined in pairs, but all four jaws can be machined together when making a pair of clamps. The beginner will be well-advised to tackle a job of this kind by filing, in order to gain efficiency; for, although machining the parts may seem more attractive, the time will surely come when a particular piece of work cannot be machined in the ordinary way, and filing becomes inevitable. If the clamps are to work smoothly, it is essential to drill and tap the screw holes exactly in line, and the method adopted was to clamp the jaws together in pairs and then drill both to the tapping size. Next, the jaws, while still clamped together, were turned over for opening out one to the clearing-size to serve as a tapping guide. After the jaws have been finished to shape, they are hardened or case-hardened, according to the variety of steel used. If bone dust is used for the casing process, a finely-mottled finish can be obtained, which adds to the appearance of the tool and follows professional practice.

The Clamping-Screws

The jaws are controlled by two screws: the setting-screw and the jack-screw. When applying the clamp, the setting-screw is first lightly tightened, to close the jaws on the work and leave them lying approximately parallel; the jackscrew is then tightened with a tommy bar to obtain the full clamping pressure. The extent of the jaw opening is, of course, limited by the length of the two clamping-screws; but as these screws are necessarily of relatively small diameter, they should not be too long, or the jackscrew will be liable to bend when under compression.

When making the four screws, it will save time and having to reset the lathe tools if two lengths of $\frac{5}{16}$ in. diameter mild-steel rod are

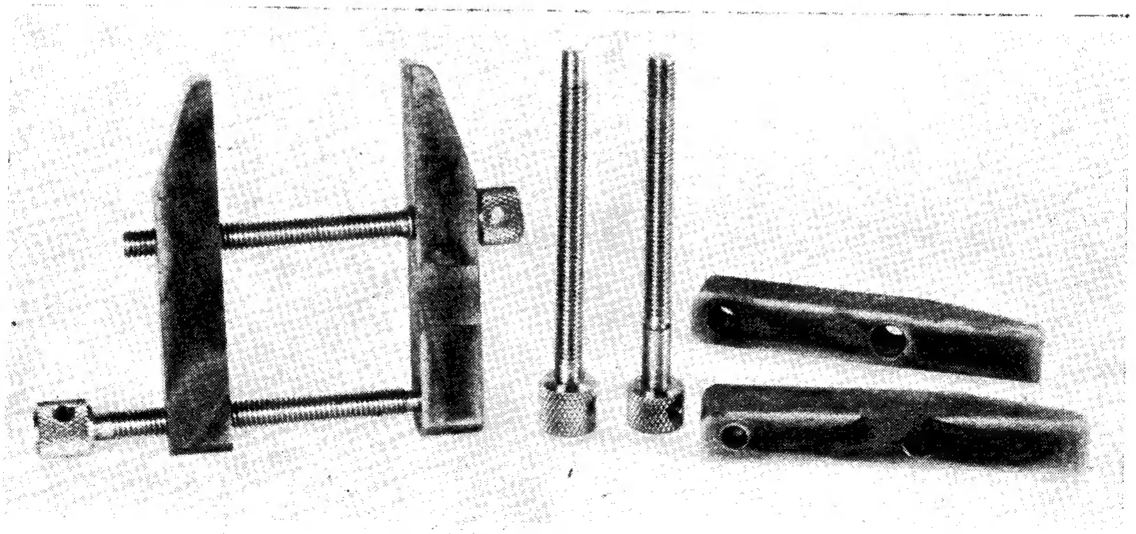
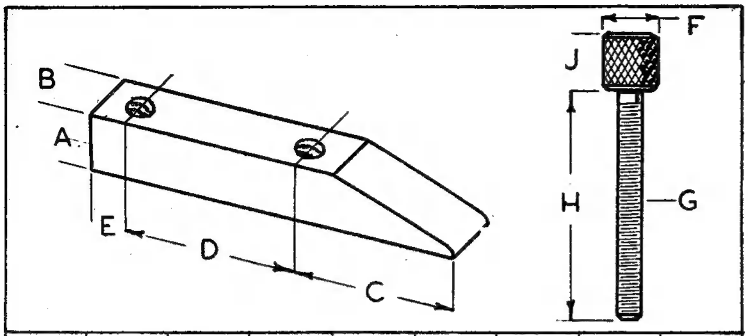


Fig. 1. The finished clamps



A	B	C	D	E	F	G	H	J
5/16"	1/4"	11/16"	3/4"	5/32"	7/32"	1/8" WHIT	$1\frac{7}{16}$"	$\frac{1}{4}$"
11/32"	5/16"	7/8"	1"	3/16"	9/32"	3BA	$1\frac{7}{8}$"	$\frac{1}{4}$"
3/8"	3/8"	1"	$1\frac{1}{8}$"	1/4"	5/16"	1BA"	$2\frac{1}{4}$"	$\frac{3}{8}$"
7/16"	7/16"	$1\frac{5}{16}$"	$1\frac{1}{2}$"	1/4"	3/8"	OBA"	$2\frac{5}{8}$"	$\frac{1}{2}$"
1/2"	1/2"	$1\frac{5}{16}$"	$1\frac{1}{2}$"	1/4"	7/16"	1/4" BSF	3"	$\frac{9}{16}$"

Fig. 2. Suggested dimensions for toolmaker's clamps

used, and one screw is machined on each of the four ends.

The first operation is to reduce the rod for $1\frac{7}{8}$ in. to 0.160 in. diameter, and a mandrel collet chuck will be found best for this purpose, as the work is held close to the mandrel nose, and true-running is assured even after re-chucking the rod.

Clearly, the work will lack rigidity, and may rise on the tool point, if an attempt is made to turn the whole length of the shank when unsupported by the back centre. However, to prepare the work for threading, the machining was carried out satisfactorily without having to centre-drill the ends of the screws.

The rod was set to project for 2 in. from the collet chuck, and the small diameter, 0.130 in., at the tip of the jackscrew was first turned; next, the rod was turned down to the finished diameter for a length of 1 in. only; the remaining $\frac{7}{8}$ in. of the shank was then machined to the same diameter. In this way, with the lathe running at high speed, the screw shanks were turned parallel and to a good finish.

When this method of turning slender work is adopted, a really sharp knife tool is used, and it should be set, as shown in Fig. 6, with the cutting edge at right-angles to the line of travel; the main cutting pressure is then axial and the radial thrust is very small. It might well be suggested that the travelling steady should be used to support the

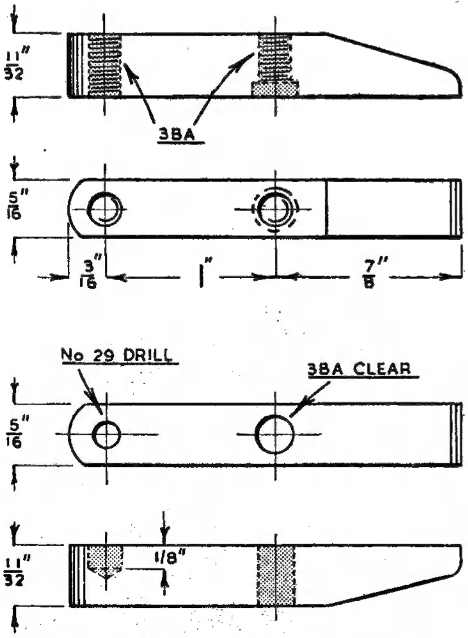


Fig. 3. The upper and lower clamp jaws

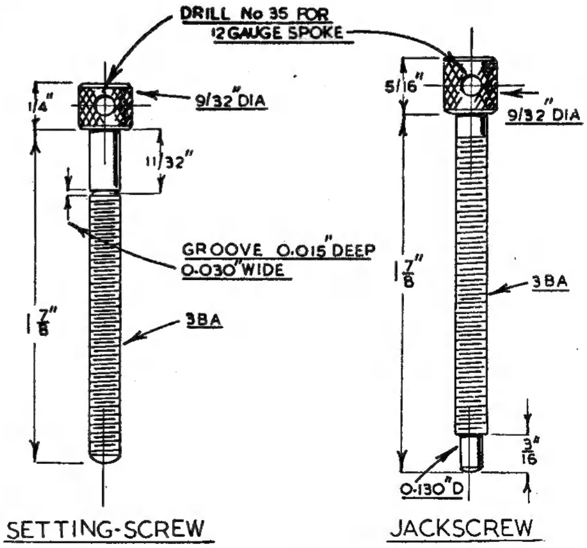


Fig. 4. Details of the two clamping-screws

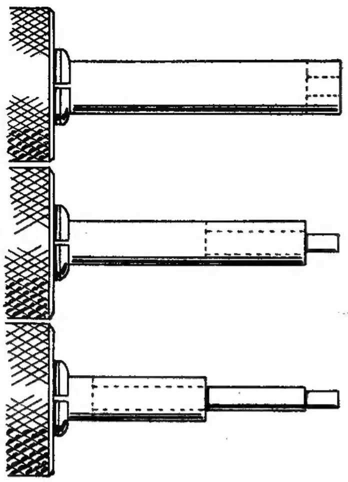


Fig. 5. Stages in turning the screw shanks

work, but it was not found possible to mount the steady when the lathe top-slide was extended to bring the tool up to the work and, at the same time, keep the saddle on its guide-ways. However, if a large number of these parts had to be made, it would be better to use some form of box tool fitted with a self-contained steady bearing.

After the four screw shanks have been machined, they are threaded either with the tailstock die-holder or in the bench vice with a colleted die-holder.

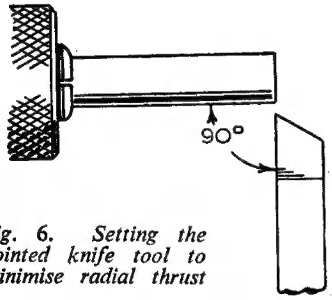


Fig. 6. Setting the pointed knife tool to minimise radial thrust

The usual way of retaining the setting-screw in place in the clamp is to attach a small forked member to the jaw, but to reduce the length of the screw head, a circlip is used instead.

These clips were made by winding a few turns of 22-gauge steel wire on the plain part of the screw shank and then cutting off a single coil. If the groove for the clip is turned in the screw shank not more than some 15-thou. of an inch deep, it will not weaken the screw more than does the screw thread.

The holes for the tommy-bar can now be drilled in the screw heads with the aid of a suitable jig, such as that previously described in this journal. After the heads have been knurled, the screws are parted off to length and the heads faced by reversing the work in the chuck.

The screws were made of mild-steel, but if an attempt is made to case-harden them they are almost sure to distort, and the free-working of the jaws will then be upset. Unhardened screws should, however, give satisfactory service in the amateur workshop, and the screws fitted to best-quality, commercial clamps are, we find, left unhardened in the smaller sizes.

The most suitable material for making the tommy-bar is, perhaps, a length of the 12-gauge steel wire used for the spokes of motor-car wire wheels.

I.Mech.E.—Coronation Exhibition of Models

(*Continued from page* 49)

only 4 in. long. Mr. McN. believes that it is probably the smallest "dockyard" model in existence. If it isn't, I would certainly like to see the smallest. Personally, I believe that if a smaller one is ever made, it will be constructed by one of the McNarry's. Mrs. Iris McNarry's contribution was her fine model of Brunel's *Great Western*. The comments of the ladies (and, for that matter, of their escorts), on seeing that the builder was of the feminine persuasion, were entertaining.

A Member's Models

Mr. S. A. Walter had a double interest in the show, for in addition to being an excellent model-maker, he is a member of the I.Mech.E. of long standing. Perhaps it was only appropriate that he should submit two models, therefore. One of them was his model of a 6-in. naval gun, which has a rifled barrel. To the knowledgeable gentlemen who said that the model gun could not possibly be fired, it was explained with some relish that it not only could be, but it had been! Mr. Walter's other exhibit was his Leyland fire-engine, with that delightful collection of equipment laid out at the side. This model was actually on loan to the Science Museum at South Kensington, and thanks are due to the museum staff for their ready help.

These folk who make small pieces of equipment and machinery that look too good ever to be degraded by actual use were well represented by the 2-in. centre experimenter's lathe which drew so much attention at Westminster a few years ago. Again, the builders, Mr. R. Turner and Mr. W. Fowkes, deserve profound thanks for the trouble taken in bringing the machine all the way from Derbyshire for a "one-night stand."

The last bright star in this galaxy of loaned models was Mr. H. A. J. Smith's one-third size overstrung piano. Those visitors who found pleasure in the craftsmanship put into the instrument were even more delighted to find that it actually played with a tone not far removed from that of a full-size piano.

Many were the musical ones who bemoaned the fact that their fingers were too large to play it properly. As one lady remarked, all that we needed was an accomplished mouse!

To round off the exhibition, a few of the Institution's own models were on show. One was the late Dr. Bradbury Winter's renowned *Silver Rocket*, perhaps the most exquisite piece of locomotive modelling ever produced, while another was the Caledonian Railway 4-4-0 passenger tender locomotive built by the late Mr. W. H. Dearden. A novel exhibit was a model of the Institution's crest—a rearing horse harnessed with collaret and chain, supported on a globe—carved from a single piece of wood by Mr. G. H. Lanchester, M.I.Mech.E., a prominent member of the Institution's Automobile Division.

Quality

The keynote of the exhibition was quality rather than quantity, and it is beyond question that this aim was achieved. The setting for such a fine display, amid the dignity of oaken panelling and beneath the great portraits of George Stephenson and James Watt, was perhaps unique, and the presence of the members and their ladies blending the formality and colour of their evening dress created a scene which will long be remembered.—R.M.

A unique helicopter

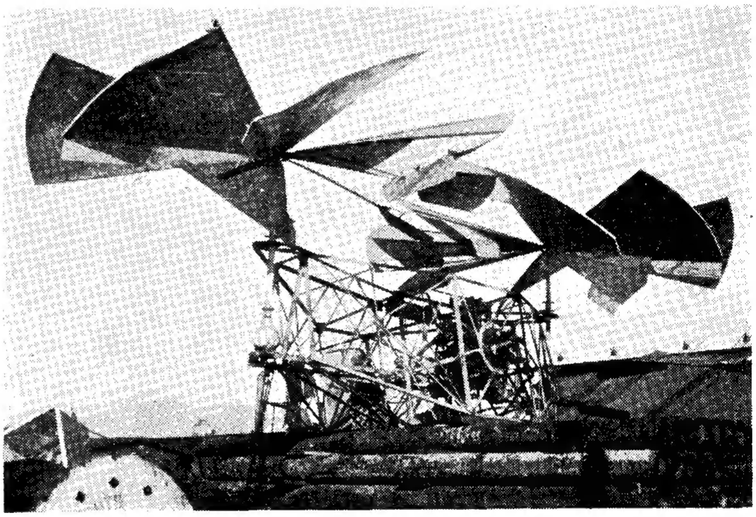
AMONG some photographic negatives recently sent us by Mr. Robt. C. Fairall, of Vancouver, B.C., there was one that especially intrigued us ; so we took a print from it and reproduce it herewith. Incidentally, the negatives were all on a strip of film, and the others consisted of some views of an old Shay geared locomotive and will probably appear later in a separate article.

Mr. Fairall had supplied some information about the old engine, but did not even mention the wonderful contraption seen in the photograph reproduced here ; so when we returned his negatives, we told him that we had printed this one and asked if he could supply any information about it. His reply was very brief but to the point :

" You enquire about the ' double windmill ' ; well, the story is about the usual type. A local enthusiast set about to build a helicopter device, in the 'twenties, I guess, and when he finally achieved ' ascension ' by another route, the heirs, assigns and successors got what credit they could from the junk man, who saw it had possibilities in the form of a trade mark or advertising sign ; and there it sits in the breeze on Main Street, Vancouver.

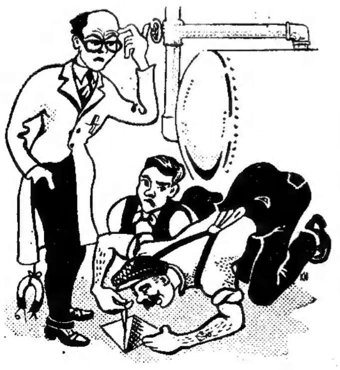
" We photographed it for an *ex*-R.A.F. pilot who was returning to England, so that he could prove the population here was actually crazier than it was said to be in England. A low power glass will reveal that the constructor was woefully ignorant of strength of materials, design of structures, to say nothing of aerodynamics, etc. I left England in my early twenties, so that I know similar types of perpetual motion designers existed there ; but still being in my twenties, I did not have time to count them all."

We endorse Mr. Fairall's comment concerning the constructor's lack of fundamental knowledge, though we doubt if all the revealing details will be discernable in the reproduction of the photograph.



THE DEPTH OF IT

A LARGE horizontal steam engine was about to be fixed in an ice works in the Midlands. The foundation of concrete was all ready, with the necessary bolt holes, these being 4 in. square and about 7 ft. deep, arranged for a square plate to be passed through a side opening at the bottom.



Among the various tools on the job was a short bar which one of the men called a " locating bar," the bar being pointed at one end and flat at the other, and (fortunately) with a slight bend.

During the course of operations, the bar was allowed to fall into one of the foundation bolt-holes, and little was thought of it at the time, but when the time came for putting the bolt in the hole, it was found that the locating bar would have to be moved. This was found to be no easy job, owing to the confined space.

The first move was to procure an electric torch and suspend it on a wire to let it down the hole. Next, a strong magnet was let down, but without any result. After a delay of more than two hours, an old millwright (one of the old school) came sauntering over to see what was wrong. After weighing matters up, he quietly walked away to the scrap dump and returned carrying two lengths of scrap tubing of different sizes, and long enough to reach to the bottom of the hole. Having lowered the torch to the bottom of the hole he followed with one of the tubes, and by using as he said, " a bundle of patience " he passed the lowered end of tube over the end of the offending bar, which, as mentioned previously, was slightly bent. By exerting pressure on the tube, the bar was jammed into the tube and brought to the surface, much to the relief of those in charge.—P. ROBINSON.